soils on the global agenda

Developing International Mechanisms for Sustainable Land Management

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Cover photo: Attempt to stabilise an area of mobile sand dunes near the city of Wuhai in the Inner Mongolia Autonomous Region of the People's Republic of China. Photo by Malcolm Douglas

soils on the global agenda

Developing International Mechanisms for Sustainable Land Management

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Acknowledgements

This publication is based on the presentations and discussions made by selected contributors who were invited to a special one-day Symposium by the IUSS Working Group IASUS (International Actions for the Sustainable Use of Soils) held on 9 September 2004 in the framework of the Eurosoil Conference held in Freiburg, Germany from 4-12 September, 2004. The names and affiliations of these contributors are given in the Annex. The editors are equally grateful for the efforts made by the members of the IUSS-IASUS Working Group, who helped in organising the Symposium, and contributed to the priority setting for the international soils agenda, initiated through a participatory process after the Symposium, in 2005 and 2006.

Preparation of this publication was possible thanks to the dedicated help of a number of colleagues of the Centre for Development and Environment (CDE), University of Bern. Last but not least, much of the activity of the IASUS Working Group was – and still is - only possible because of the in kind contributions of the individual members and their institutions, and the contribution regularly made by the Swiss Agency for Development and Cooperation (SDC), Natural Resources and Environment Section, since 2001.

Bern, June 2006
The editors: Hans Hurni (IASUS Chairman), Markus Giger (CDE), and Konrad Meyer (IASUS Secretary)

Abbreviations

CDE	Centre for Development and Environment, University of Bern
ESPA	Environmental Sciences & Policy Assessment
FAO	Food and Agriculture Organisation of the United Nations
GEF	Global Environment Facility
GLADA	Global Assessment of Land Degradation and Improvement
GLASOD	Global Assessment of Soil Degradation
IAASTD	International Assessment of Agricultural Science and Technology for Development
IASUS	International Actions for Sustainable Use of Soils
IPLS	Initiative for an International Panel on Land and Soils
ISCO	International Soil Conservation Organisation
ISRIC	World Soil Information, Wageningen
IUSS	International Union of Soil Sciences
LADA	Land Degradation Assessment in Drylands
MA	Millennium Ecosystem Assessment
SLM	Sustainable Land Management
SOWAP	Soil and Water Protection Project (EU-funded)
UNCBD	United Nations Convention on Biodiversity
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WASWC	World Association of Soil and Water Conservation
WCSS	World Congress of Soil Science
WOCAT	World Overview of Conservation Approaches and Technologies

Preface

At the 40th anniversary of ISRIC, the World Soils Information Centre, a group of imminent stakeholders in soil science and related disciplines met in Wageningen on 9 and 10 March 2006 and debated the need to enhance soils policy and action at the national and international levels. The group felt that international treaties, conventions and assessments at the global level had so far largely neglected sustainable use of soils. They concluded that soils, the ground in which terrestrial land use is rooted, need a much stronger voice and lobby, equal to those that advocate for climate, biological diversity, forests, wildlife and water, which are acknowledged as natural resources and perceived as an indispensable basis of human well-being in the international community and the public at large.

The International Union of Soil Sciences (IUSS), the scientific community focusing on soils and soil research, had been concerned about this need for a number of years, and has already taken a number of actions. At the World Congress of Soil Science held in Bangkok in 2002, the General Assembly of IUSS unanimously adopted a 9-point "World Soils Agenda", which included tasks for science, monitoring and research, for policy guidance, and for support of implementation. This agenda defines important principles and actions at the international and national levels for sustainable use of soils. It was developed prior to the congress by the IUSS Working Group "International Actions for the Sustainable Use of Soils" (IASUS).

Two years later, at the "Eurosoil" Conference held in Freiburg, Germany in September 2004, the IASUS Working Group resumed its initiative and organised a special Symposium called: "Putting soils higher on the international agenda - new mechanisms in support of sustainable land management". The need for an improved science-policy dialogue through an appropriate mechanism was highlighted by a number of invited presentations and a panel discussion involving representatives from key international programs and institutions. The Symposium attempted to provide an overview of science and policy-focused international actions on sustainable land management, and to identify potentials for increased added value through closer cooperation and better dialogue amongst science, policy and society.

After the Symposium, both IUSS and IASUS continued their efforts to put soils higher on the international political agenda. On the one hand, IUSS initiated the preparation of a series of policy briefs related to the themes "Soils and Climate Change", "Soils and Land Use Planning", "Soils and Water", "Soils and Human Health", "Soils and Poverty Alleviation", and "Soils and the International Environmental Conventions". On the other hand, IASUS continued to set the agenda for further action by prioritising what could be done to improve international mechanisms for sustainable soil management.

The IASUS efforts resulted in the present publication, "Soils on the Global Agenda". I hope that participants at the IUSS World Soils Congress to be held in Philadelphia in July 2006 will perceive this outcome as an important initiative of the IUSS soil science community towards sustainable use of soils at the global level, and that a wider group of stakeholders in international organisations will take the necessary steps to give greater attention to soil issues in their activities.

Reading, in June 2006
Professor Stephen Nortcliff
Secretary General, IUSS

Authors of Part I

Hans Hurni, CDE
Konrad Meyer, ESPA
Markus Giger, CDE

Background

A special Symposium was organised on 9 September 2004 by the IASUS Working Group of IUSS, on the occasion of the Eurosoil Conference held in Freiburg, Germany, from 4-12 September 2004. The Symposium focused on "Putting soils higher on the international agenda"; it invited a number of specialists to contribute to international efforts towards sustainable land management. Part I of this book summarises the main activities and outcomes of the Symposium.

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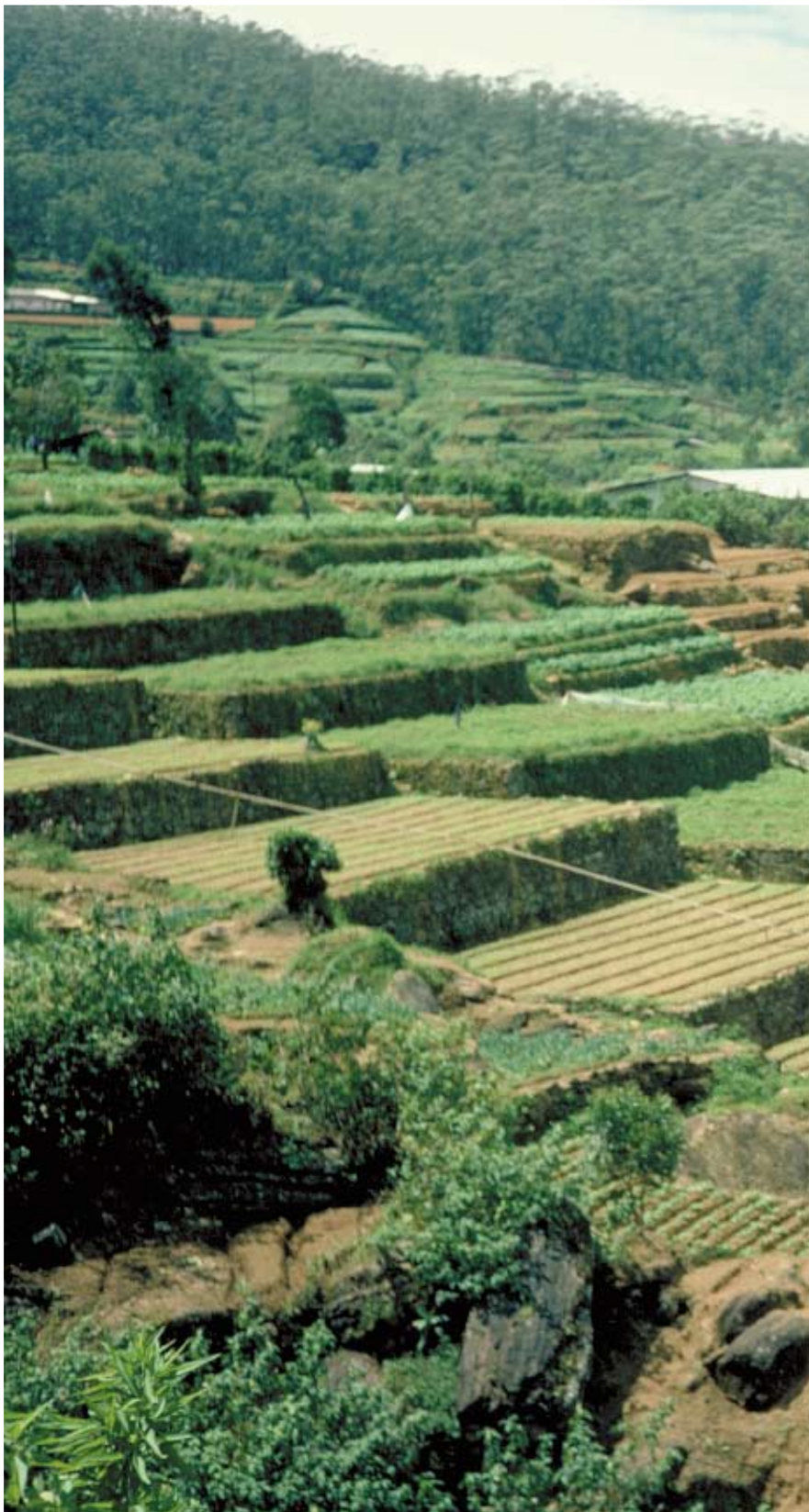
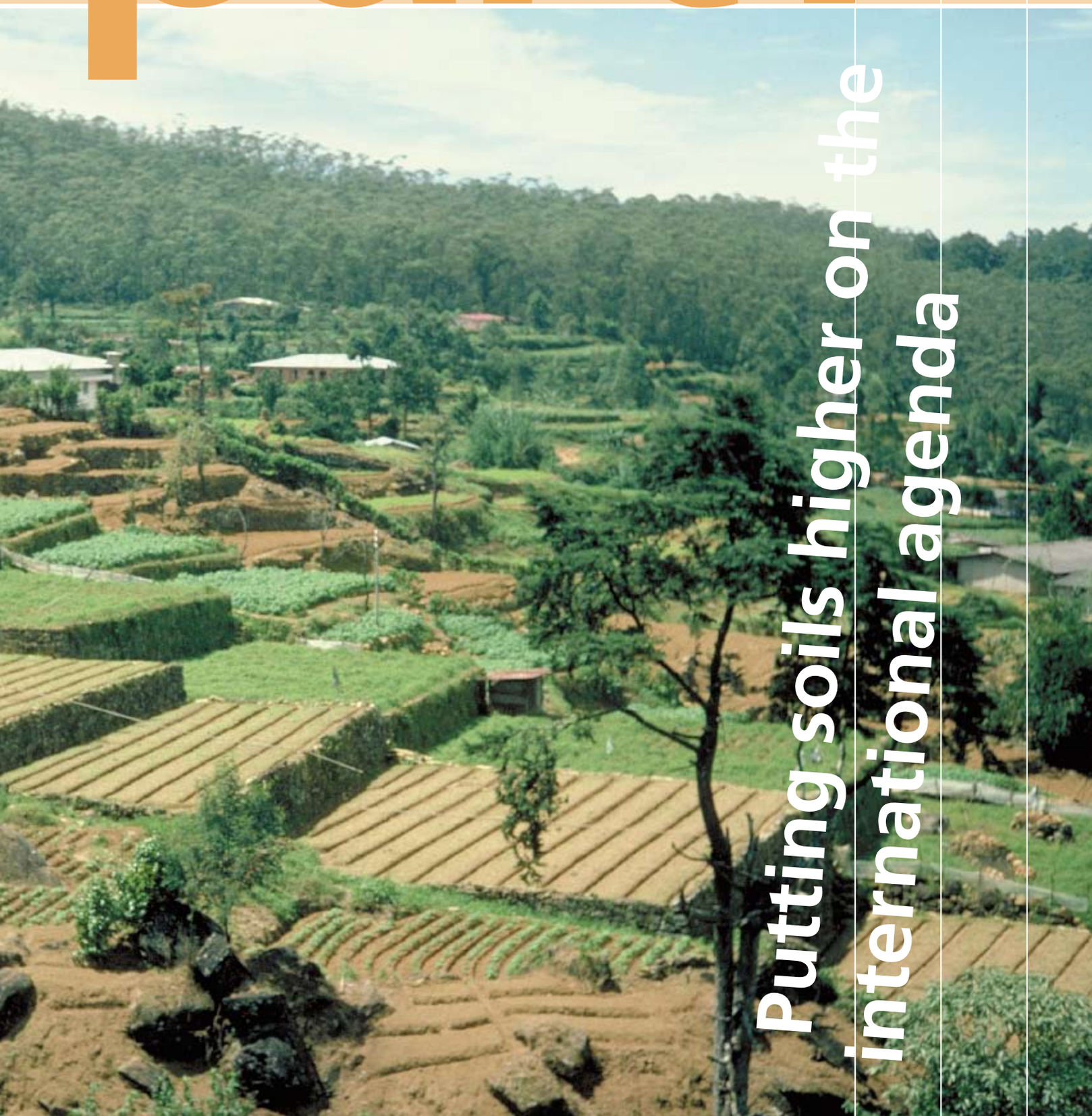


Right:
Intensive terracing for horticulture in the Highlands of Nurelia, Sri Lanka. Photo by Hans Hurni

part I



Putting soils higher on the international agenda

A Symposium on global soil issues

Background

A number of international mechanisms have recently included soils as a natural resource of vital importance. Be it for carbon sequestration, soil biodiversity preservation, as a basis for agricultural production or simply a living space, soils have multiple functions that are vital to global sustainability of the earth as a living system and basis for human survival.

But how can these multiple demands be satisfied? Where are the specialists willing to invest time and resources to putting soils higher on the international agenda? Are soil and land management specialists involved in the Millennium Development Project? Are soil issues adequately covered by the Framework Convention on Climate Change? Or in the Convention on Biological Diversity? The Convention to Combat Desertification? Does the Global Environment Facility promote enough projects dealing with sustainable land management? Stakeholders caring for healthy soils are invited to become much more active in these mechanisms.

So far there is little indication of effective international cooperation between scientists, policy makers and other stakeholders in relation to combating land degradation and furthering sustainable land use and management.

The Eurosoil Conference was used as an occasion for an initiative by the IUSS Working Group IASUS to help improve the status of soils on the international policy agenda. IASUS is the acronym for "International Actions for the Sustainable Use of Soils". The Working Group was established by the international Union of Soil Science (IUSS) in 1998 and prepared the World Soils Agenda (Hurni and Meyer, eds., 2002) adopted by IUSS in 2002. The need for improved science policy dialogue through an appropriate mechanism was highlighted at Eurosoil by presentations and a panel discussion involving representatives from key international programs and institutions.

Objectives

This one-day Symposium was held on 9 September 2004 and attempted to provide an overview of science and policy-focused international actions on sustainable land management, to identify potentials for increased added value through closer cooperation and better dialogue amongst science and policy (society), for instance through the mechanism of an international panel on land and soils. Specifically, the Symposium aimed to convene representatives from major international organisations, to share information on their work in relation to soil and land use issues, and to reflect on the need for further action on soil degradation and sustainable land management.

The World Soils Agenda

IASUS Chairman Hans Hurni opened the Symposium with a contribution entitled "Challenges and Implementation of the IUSS World Soils Agenda adopted in 2002". He reminded the participants of the contents of the agenda adopted, and especially the contributions that are expected from the community of soil scientists.

Hans Hurni referred to the importance of the multi-level stakeholder approach, which has evolved over the last 40 years and is the approach currently taken by leading institutions worldwide to assess and negotiate conflicting issues of natural resource management and global environmental change, and to agree on improvements. Policies that support sustainable land management must address scientific and strategic issues, respond to current and future challenges, and take into account the accumulated experiences of stakeholders at all levels (cf. Fig.1).

Apart from the Symposium being an open forum for participants to interact with key stakeholders in science, higher education and policy, it also helped shape the actions of the IUSS Working Group. IASUS functioned as a body of independent opinion leaders who act together to shape global, regional and national science, policy making, and implementation to support sustainable land management in future.

A World Soils Agenda

Agenda 1: Assessing the status and trends of soil degradation at the global scale

Agenda 2: Defining impact indicators and tools for monitoring and evaluation

Agenda 3: Developing principles, technologies, approaches and enabling frameworks for sustainable land management

Agenda 4: Identifying an international, multi-disciplinary network for soil issues

Agenda 5: Establishing an intergovernmental panel on soils

Agenda 6: Providing guidance to develop and implement national soil policies

Agenda 7: Promoting initiatives for sustainable land management

Agenda 8: Ensuring inclusion of soil-related issues in development programmes

Agenda 9: Providing guidance for national and local action

(IUSS Resolution, 17th WCSS Bangkok, 2002)

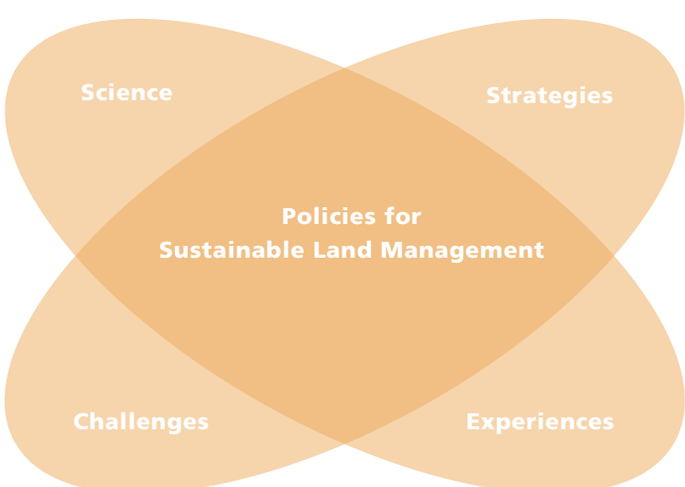


Figure 1: Issues in policies for Sustainable Land Management (cf. Hurni, p 23)

Science in support of sustainable land management policies

One of the main tasks for science in support of sustainable land management (SLM) is to produce evidence on the impact of land degradation on natural resources, particularly soils, and to assess the implications on society, economy and policy from such impacts.

At the Eurosoil Symposium there was a clear consensus regarding the need for more detailed, convincing, credible "hard" data regarding the extent and impact of land degradation worldwide. In particular, the need to quantify the economic costs of land degradation was highlighted, despite all the difficulties involved in such a quantification exercise. In particular, GLASOD (Global Assessment of Soil Degradation) was seen as influential and widely used, although there are scientific and practical problems (no linkage to land users' concerns and sustainable land management (SLM) practices).

The following current assessment efforts were presented:

LADA

The project "Land Degradation Assessment in Drylands" is an important international assessment hosted by FAO. It is directed towards policy change and is action-based. The objective is to build assessment capacities to enable analysis, design, planning and implementation of interventions to mitigate land degradation and establish sustainable land use and management practices. Methods and tools will help to assess, quantify and analyse the nature, extent, severity and impacts of land degradation on ecosystems, watersheds and river basins, and carbon storage in drylands, at a range of spatial and temporal scales. Changes in the "capital assets of rural livelihoods" caused by degradation or rehabilitation are assessed, using the DPSIR approach. Michael Stocking underlined the importance of sustainable management of drylands for poverty alleviation and stressed opportunities for collaboration with WOCAT.

WOCAT

The programme "World Overview of Conservation Approaches and Technologies" is a worldwide network, with a secretariat at CDE in Bern. Its mission is to share knowledge about soil and water conservation technologies and approaches, and support decision-making in the field and at planning levels. As Godert van Lynden explained, WOCAT concentrates on promising and successful approaches and technologies in sustainable land management in different social, economic and ecological contexts. It is based on the assumption that there are still many knowledge gaps, misconceptions and false assumptions regarding sustainable land management at all levels, which must be addressed through training, evaluation and scientific cross-checking. WOCAT offers a comprehensive approach to monitoring, evaluating and appraising soil and water conservation technologies and approaches. It offers evaluation tools, tools for international exchange (website, on-line tools), workshops and training, conferences, and awareness building and training. It also aims to bridge the gap between research and policy.

Far left:
Heavy surface runoff caused by extreme rainfall. Central Ethiopian Highlands.

Left:
Labour-intensive construction of terraces to prevent soil loss. Central Ethiopian Highlands.

Photos by Jürg Krauer

GLADA

The project idea "Global Assessment of Land Degradation and Improvement and Early Warning", was presented by David Dent, ISRIC. Its aim is to provide better data for policy, planning, investment and action related to food and water security, forestry, biodiversity and environmental services. This research programme (currently in a pilot phase) aims to produce data that are quantitative, reproducible by defined procedures, and allow universal comparisons. It is based on an innovative approach to assessment of resource degradation and improvement through better forecasts, monitoring and early warning. It will use global satellite data that permit measurement of global change from the local to the global scale. Biomass will be used as an integrated measure of biological productivity.

MA

The "Millennium Ecosystem Assessment" was launched in 2001 and is governed by a number of UN bodies and governmental and private sector representatives. MA was designed to meet the needs of decision makers and the public for scientific information about the consequences of ecosystem change, including changes to land and soil ecosystems. In particular, the programme is expected to provide various multilateral environmental agreements (such as CBD and UNFCCC) with such assessments. The MA is based on available data and does not generate new empirical data. Soil and land issues have not figured very prominently in the reports available up to now. The results of the MA should be examined in greater detail and commented on by IASUS.

Strategies to support sustainable land management

Different organisations have different strategies and programmes to support sustainable land management (SLM). Four major strategies were described at the symposium: the strategies of UNEP, EU and Germany, and a new idea for an international mechanism.

UNEP's approach to land management

Jens Mackensen presented UNEP's approach to land management. He addressed the environmental dimensions of land use management and soil conservation as they relate to the overall objectives of sustainable development and poverty reduction. In its recently published strategy for land use management and soil conservation, UNEP suggested applying the Ecosystem Approach as developed under the CBD to land- and soil-related matters. UNEP recognises deficits in the scientific and advisory processes of existing multilateral environmental agreements, such as poor inter-linkages between these agreements (linkage gap), poor management of data (data gap) and lack of support for implementation (impact gap).

Coherence between the agreements needs to be enhanced through commonalities in scientific and advisory processes, with benefits from assessments such as the Millennium Ecosystem Assessment, the UNEP Science Initiative, and the Assessment of Agricultural Science and Technology for Development.

Options for better integration of soil issues in multilateral environmental agreements include:

- closer co-operation on land and soil issues amongst existing advisory bodies,
- a mandate for an existing advisory body to take the lead in encouraging collaboration, and
- establishment of a new independent advisory body on land/soil protection and management.

Since soil is not perceived as a global common, no sufficient international framework on soils exists, although widespread references to soil issues can be found in international environmental agreements. While overlap and competition with UNCCD should be avoided, discussions on a new instrument could include a framework treaty and a protocol to an existing treaty. Unfortunately, there is a perceived reluctance among the international community regarding new international bodies. Increased emphasis at the national level is therefore an important complement to any international approach. Therefore, the IUCN Sustainable Soils Working Group addresses deficits in national instruments through its initiative for national soil policies and legislation.

Experiences in the EU

From an EU perspective, Luca Montanarella described ongoing efforts to better address the manifold challenges with regard to sustainable use of lands. A coherent approach to soil protection in Europe is just beginning. Policy-relevant features call for local perspective, prevention and precaution, anticipation, protection and environmental liability. An EU strategy "Towards a Thematic Strategy for Soil Protection" is currently under development. It will include elements like soils as multi-functional entities that require horizontal cross-sectoral policy guidance (between agricultural policy, water policy and waste policy). It will also be knowledge-based and therefore include a European Soil Information System and a Soil Monitoring Directive. Suggestions for progress are: (a) improve policy-relevant soil information, (b) implement existing legislation and multinational environmental agreements, (c) monitor the impact of existing legislation on soil protection, and (d) develop (if necessary) specific legislative instruments for soil protection.

Far left:
Experimental plots for testing agroforestry systems in Mae Muang Luang, northern Thailand.
Photo by Hans Hurni

Left:
Lupine plants used as green manure, Bolivia.
Photo by Martin Moll

All these elements are still to be defined in the EU Thematic Strategy for Soil Protection. An initial framework has been provided by the recent revision of the Common Agricultural Policy that has put soil protection at the centre of good agricultural practices.
The EU also plans to expand its assessment activities beyond the boundaries of the EU towards northern Africa, the Near East, and Eastern Europe and the CIS countries.

Experiences from Germany

Joachim Woiwode summarised the German experience in matters of soil policy. Within a framework of ecological and sustainable land management, soil must remain able to fulfil its different functions. The removal or reduction of existing soil pollution, and remedial soil conservation, are important areas of policy. New soil damage should be avoided as much as possible. The objectives and principles of soil conservation must be integrated in all policies. Therefore, comprehensive exchange of knowledge and practical experience between scientists, planners, administrators and politicians is indispensable. Bearing all this in mind, the German approach is built in particular on the Federal Soil Protection Act and the Federal Regional Planning Act. The purpose of the Soil Protection Act is to protect or restore the functions of the soil on a permanent, sustainable basis. Actions to this end should include prevention of harmful soil changes; rehabilitation of the soil, of contaminated sites and of waters contaminated by such sites; and precautions against negative impacts.
The Regional Planning Act provides the organisational framework for spatial planning in Germany. It is specified by legal provisions, programmes and plans within the German Laender and regions. Note: Politicians and administrators need methods and parameters based on scientific and practical efforts that can be handled easily and that indicate the success or non-success of activities and measures, as well as failure.

The issue of an Intergovernmental Panel on Land and Soils (IPLS)

The need for a new Intergovernmental Panel on Land and Soils (IPLS) is based on the fact that no single binding multilateral agreement at global level focuses specifically on soil degradation, soil protection and sustainable land management (SLM). There have been some attempts to develop initiatives for a global soil convention (http://www.soil-convention.org/english.htm) by private organisations and NGOs, but no formal steps have been taken so far in this direction by any country.

Interrelated global environmental problems, however, require international coordination of global change research, which is a prerequisite for sustainable development. The IPCC has fostered international policy development, awareness and debate, as well as monitoring and research efforts. An Intergovernmental Panel on Land and Soils (IPLS) was advocated by Hartmut Grassl because: (a) soil degradation lasts longer than anthropogenic climate change, (b) wrong land uses practices cause net soil losses and lead to migration, (c) successful methods/techniques need to be compiled and communicated, and (d) political decisions are more likely if sound scientific assessment is available.
At UNCCD COP-5 (2001) a proposal by developing countries (G77 and China) to explore the possibilities of establishing such a panel failed to gain sufficient support. The speaker also urged a reform of the UN in relation to environmental issues.

International experiences in sustainable land management

The Rio Conventions

The Framework Convention on Climate Change (UNFCCC) addresses the sources of greenhouse gases and sinks, related to land use and land use changes (agriculture and forestry). The Convention promotes sustainable management, conservation, and enhancement of carbon sinks and reservoirs in developing countries. It also promotes cooperation in preparing for adaptation to climate change, including impacts on land. The Kyoto Protocol fosters conservation and expansion of carbon storage above and below ground, through accounting of net changes in greenhouse gas emissions from afforestation, reforestation and deforestation, and through management of forests, cropland, grazing and revegetation. Potentially, this convention is therefore of great importance to land management, as soils are important carbon sinks. The sustainable use of soils as carbon sinks is probably an opportunity not yet fully explored by soil scientists and treaty negotiations. The issue has clearly not received enough international attention.

The Convention to Combat Desertification (UNCCD) is seen as the enabling framework for countries (mostly in semi-arid regions) to work on soil conservation and sustainable land management. Its Committee on Science and Technology assesses desertification and research in land degradation, and develops methodologies for assessing poverty and land degradation, including monitoring and early-warning systems for desertification. Through its thematic focus, it is the convention with the closest potential connection to the land issue. However, its geographical focus is not global in the sense that it covers all terrestrial ecosystems. GEF has become the main funding mechanism for UNCCD through its Operational Programme No 15 (Sustainable Land Management). This is an acknowledgement of the importance of land issues on the international level.

Sustainable land management is also relevant to the Convention on Biodiversity (CBD). The framework for implementing CBD is a strategy for the integrated management of land, water, and living resources. The approach encompasses human as well as ecological perspectives ("ecosystem approach"). As a current activity of special importance related to sustainable land management, Michael Stocking presented the FAO International Soil Biodiversity Initiative. Soil biodiversity has been identified as an area requiring particular attention, under the programme of work on agricultural biodiversity of the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD). The Soil Biodiversity Initiative has the following objectives:

1. Sharing of knowledge and information and awareness raising
2. Capacity building, to develop and transfer knowledge about soil biodiversity and ecosystem management into practices used by farmers
3. Strengthening collaboration among actors and institutions, and mainstreaming soil biodiversity and biological management into agricultural and land management and rehabilitation programmes.

Land degradation is one of the focal areas in the Global Environment Facility (GEF), the funding mechanism for the multilateral environmental agreements mentioned here. Anna Tengberg provided insight into GEF's programmes. Activities addressing land degradation are funded primarily through the operational programmes (OP) under this focal area, in particular OP 15 (on Sustainable Land Management) and OP 12 (on Integrated Ecosystem Management). As a cross-cutting issue, land management is also funded through several operational programmes under the biodiversity and the international waters focal areas. GEF is a co-financing agency that provides "new and additional" funds to address global environmental

Far left:
The carbon sequestration potential of soils is substantial when soil organic matter is increased. Below-ground organic carbon storage capacity is more than double the above-ground capacity. Aachen, Germany.
Photo by Silvia Lazar

Left:
Scarce vegetation resources in the dry highlands near Amran, Yemen.
Photo by Hans Hurni

issues and encourages partnerships by bringing together multiple sources of funding for projects.

Under OP 15, especially capacity building, on-site investment and targeted research can be funded. OP 15 aims at mitigating the causes and negative impacts of land degradation on ecosystem stability, functions and services through sustainable land management practices, to improve people's livelihoods and economic well-being. GEF's implementing agencies include the UNDP, UNEP, and the World Bank.

Synergies between the conventions

This issue was addressed by several speakers. Luca Montanarella sees the soil organic carbon pool, one of the major global carbon pools (estimated 1500 Pg), at the core of these conventions, making it highly relevant to the UNFCCC. But soil organic carbon is also the major pre-condition for life in soils, and therefore there is a close link between soil organic carbon levels/quality and biodiversity in soils. This aspect therefore directly concerns the UNCBD. Finally, soil organic carbon is a good indicator of desertification processes, since it is closely linked to temperature and humidity. Hence there are a number of implications within the UNCCD process.

Markus Giger pointed out that integration of the objectives of the three conventions must be realized at the local level and benefit local communities. Synergies must therefore be realized at this level. More sustainable and efficient use of energy from biomass – a substitute for fossil fuels – is an example of a promising intervention strategy.

Parties to these Rio Conventions have repeatedly pointed out that there is a need for firmer convergence of the strategic approaches that the various interested parties have hitherto pursued, particularly at the individual country level. Moreover, the need was also recognised for Parties to focus more on a broader framework that includes a complex set of issues encompassing desertification and land management, biological diversity, climate change, and socio-economic development, among others. In particular, in order to address the intertwined issues of poverty eradication, sustainable development and environmental security more concretely, the three Rio Conventions expressed the need to join efforts to avoid addressing these issues separately.

In order to further strengthen the links between the three Rio Conventions, a specific workshop was organised in 2004 in Viterbo, Italy, entitled "Forests and Forest Ecosystems: Promoting Synergy in the Implementation of the Three Rio Conventions". A similar initiative is urgently needed for soils and could be the first step towards a more coherent approach to soil protection at the global level. The IASUS initiative of IUSS could play a key role in this respect in the future.

Conclusions

Winfried E.H. Blum summarised and commented on the discussion so far. He emphasised that "sustainable land management is a political and not a scientific issue". Sustainable land management requires trying to "harmonise" all land uses in a given area and avoiding or minimising irreversible impacts. Science, however, can contribute to sustainable land management by addressing the reasons for (and problems of) land degradation in different regions, using inter- and multidisciplinary methodologies to develop relevant scenarios for politics and decision-making. Blum underlined the need to develop more policy- and decision-making by means of interdisciplinary and multidisciplinary co-operation.

Global challenges for sustainable land management

A panel discussion among the contributors to the Eurosoil Symposium was organised, guided by three main questions. The participants in the symposium were also invited extensively to express their opinions on each of the main questions.

Question 1:
What should be done to foster soil protection and sustainable land management on international agendas?

A general consensus emerged that a "mainstreaming" of soil issues should be achieved. As there are considerable reservations among political stakeholders at the global level about the creation of new international bodies, the panel believes that the trend is more towards making existing structures work better or enhancing their status (e.g. UNEP). The national level was mentioned as a very important entry point, as well as the experience of the EU, which is apparently very promising. Additional statements mentioned the need for better data and better communication, and for more capacity building, education, research and development. In general, there is a need for better tools to evaluate soil use and the driving forces behind soil degradation.

Question 2:
Your vision and approaches (reactive "problem-solution" vs. pro-active "innovation")?

The panelists addressed the questions in various ways, and there was no clear consensus. However, everybody agreed that no simple solutions are available. Innovation is very important, and must be supported.

A positive approach to soils was seen as very important. It is easier to attract policy-makers and raise funds for "positive" CBD than for "negative" UNCCD. Applying valuation of an ecosystem's goods and services to soil issues was therefore called for. Those who use ecosystem goods and services should pay, and those who maintain them should be paid. Participants also mentioned that the discussion should move to a much broader level and include questions of harmful subsidies and international trade.

The value of soils to society should be established and communicated much more clearly to the public. This would be a way of creating real interest.

Question 3:
What will you do over the next 12 months to put soils higher on the international agenda?

Each panel member was invited in a concluding round to state what he/she would do in terms of concrete action to promote more sustainable use of soils and land.

Actions at the personal level included:

- ideas for formulating a joint, integrated and interdisciplinary research project at the European level (Blum);
- dissemination of results from an existing project (SOWAP) to the field level and the policy level in Europe (van Lynden);
- realisation of funding for a project prepared for GEF (the LADA Project) and its subsequent implementation, thus strengthening the scientific basis of land degradation and desertification (Tengberg);
- putting particular emphasis on the costs of soil/land degradation and on the benefits of soil/land conservation (rehabilitation) using the WOCAT database, in order to have greater impact on economically-driven decisions relevant to land use at institutions like the WTO (Giger);

Far left:
Children are part of the future – and of the earth where they sit and on which they subsist. Bikanhalli, Karnataka, India.
Photo by Felicitas Bachmann

Left:
After 2-3 cycles of slash and burn cultivation the soils are exhausted of nutrients. On slopes, the new scrub vegetation is often insufficient to anchor soils, making erosion and landslides a problem. East coast of Madagascar.
Photo by Andreas Kläy

- pursuing establishment of an International Panel on Lands and Soils (Grassl);
- formulating a paper on land degradation in a highly rated scientific journal (Stocking);
- emphasising an approach that values ecosystem goods and services, functions and values, thereby advancing soil issues beyond conventional approaches, and ensuring good links between the scientific community and international agendas in these matters (Mackensen);
- trying to expand knowledge transfer as an EU member country within (and outside) the EU, and trying to learn from our experiences and failures (Woiwode);
- strengthening the role beyond the 2005 EU work programme as an EU soil institution because of the EUs global responsibility, and in order to remain visible at the core of soil protection, even at the global level (Montanarella);
- using imagination, relevance and communication to promote soil issues and put them higher on the global agenda (Dent);
- better interaction between the global and local levels, to provide effective support for farmers in difficult situations, allowing improvement of their soils, making them more viable and resilient and better suited for agricultural production, and perhaps also for environmental services, which these soils provide to the global community (Hurni).

Background

Part II presents the summaries or papers prepared by the specialists invited to the IASUS Symposium held on 9 September 2004 in Freiburg, Germany, on the occasion of the Eurosoil Conference.

Contents

Right:
Traditional stone terraces in the semi-arid zone of the Anti-Atlas, Morocco.
Photo by Hanspeter Liniger

part II

Developing international mechanisms for SLM

The IUSS World Soils Agenda: background, tasks, and consequences for policies

Hans Hurni

Background

At the 16th World Congress of Soil Sciences (WCSS) of the International Union of Soil Sciences (IUSS), held in Montpellier in August 1998, participants confirmed the need for a global soils agenda, as there is a general lack of recognition of soil-related matters among the general public and government administrations. IUSS thus established a working group whose task would be to examine emerging soil initiatives at the global level. The group called itself the IUSS Working Group "International Actions for the Sustainable Use of Soils" (IASUS).

There are a number of documents and agreements with particular reference to soils at the international level, e.g. the European Soil Charter (Council of Europe, 1972), the World Soil Charter (FAO, 1982) and the World Soils Policy (UNEP, 1982). Unfortunately, their non-binding nature deprives these documents of relevance for widespread action. In other agreements soils are mentioned marginally, as in the Stockholm Declaration on the Human Environment (UN, 1972), the World Conservation Strategy (IUCN, 1980), the Rio Declaration and Agenda 21 (UNCED, 1992), and the Millennium Ecosystem Assessment (MA, 2005).

The 17th WCSS in Bangkok in August 2002 was a further opportunity for pro-active IASUS initiatives. Specialists were invited prior to the congress to write papers relating to the theme, and an e-mail discussion forum took place from December 2001 to July 2002 in preparation for a draft world soils agenda. The IUSS General Assembly in Bangkok then endorsed the draft, acknowledging that the soil science community has a special role in furthering sustainable use of soils at the global level.

A number of international mechanisms have recently included soils as a natural resource of vital importance, although only at a very modest level. The UN Framework Convention on Climate Change (UNFCCC) looks at soils in light of carbon sequestration potentials, but has so far not accepted this process as part of its clean development mechanism. The Convention on Biological Diversity (UNCBD) sees soils as vital to soil biodiversity preservation, but has made no recommendations for concrete achievements in this respect. The UN Convention to combat desertification is centred around land degradation as a core problem, affecting not only vegetation, but mainly soils, but focuses primarily on semi-arid lands only. The Millennium Ecosystem Assessment (MA, 2005) considered soils conceptually as a part of ecosystem services, although it unfortunately did not further assess soils in terms of their functions with respect to ecosystem maintenance and services. Last but not least, the currently ongoing International Assessment of Agricultural Science and Technology for Development (IAASTD, 2005) again considers soils because they are a vital basis for agricultural production, although it remains to be seen to what extent land and soil degradation are considered in the various scenarios to be developed for the next 50 years. Soils, however, have many more functions than agricultural production; they are a living space for terrestrial life on earth, a cultural value in the context of religious and social practices, and a natural resource for industrial use. In conclusion, soils have multiple functions that are vital to the global sustainability of the earth as a living system and basis for human survival and well-being.

Stakeholders concerned with healthy soils are invited to become much more active in the above international mechanisms. But how can these multiple demands be satisfied? Where are

Far left:
Silvipasture for soil and water conservation: vegetative measure with *Stylo hamata* grass in Batnawar, Madhya Pradesh, India.
Photo by Gudrun Schwilch

Left:
Learning for sustainability – a workshop where different stakeholders discuss their visions of sustainable land use in their own environment. Village in Maharashtra, India.
Photo by Andreas Kläy

the specialists willing to invest the time and resources needed to put soils higher on the international agenda? Are soil and land management specialists sufficiently involved in the Millennium Development Project? Are soil issues adequately covered by the UNFCCC, UNCB, UNCCD, MA, IAASTD? And does the Global Environment Facility (GEF) promote enough projects dealing with sustainable soil and land management?

Tasks formulated by the World Soils Agenda in 2002

Tasks for science, monitoring and evaluation

Theme	No	Agenda	Target institutions	Source bodies
Science monitoring and evaluation	1	Status and trends of soil degradation	Policy makers, UN agencies, national agencies, NGOs	ISRIC, IWMI-IBSRAM
	2	Impact indicators and tools for monitoring	National, international research and observation agencies	IUSS, ISCU, IHDP, IGBP
	3	Principles, technologies and approaches to sustainable land management	Implementing ministries and agencies, decision-support networks, research institutes	IASUS; WASWC-WOCAT; UNDP; UNCCD

Figure 2: Tasks for science, monitoring and evaluation.
Source: World Soils Agenda (IUSS, 2002)

In relation to the first task (cf. Fig. 2), there is a great need to re-assess the status and trends of soil degradation and its effect on soil functions. Since the GLASOD assessment (Oldeman, 1988) in preparation for the first global conference on environment and development in Rio de Janeiro (UNCED, 1992), no further global assessment has been done, even though the expert-opinion approach of this first attempt was considerably contested. Regional studies, nevertheless, have been initiated in South and Southeast Asia (Van Lynden and Oldeman, 1997), and a more recent initiative by FAO and UNEP will provide more data on land degradation in semi-arid lands (LADA, 2002).
The second task calls for defining indicators and tools for monitoring and evaluation of degradation and mitigation impacts. Again, the recent LADA project attempts to refine the methodology for assessing degradation. A methodology for assessing the impact of sustainable land management technologies and approaches, and developing tools for monitoring their efficiency and effectiveness, has been developed by WOCAT (www.wocat.net). The WOCAT programme, "World Overview of Conservation Approaches and Technologies," was initiated in 1992, and has since been actively engaged in over 40 countries world-wide through use of a set of methodologies for assessing, appraising and monitoring suitable technologies.

Figure 3 lists the limiting factors that have to be overcome in order to improve the main tasks in science, monitoring and evaluation. Conceptual deficiencies, capacity, benchmarks and data comparability appear to be the most urgent deficiencies seen by the contributors as most important.

In relation to developing principles, technologies, approaches and enabling frameworks for sustainable land management in general, there is a third task: developing principles, technologies and approaches for reducing and overcoming the negative impacts of all soil degradation processes, whether they are due to soil erosion by water and wind or physical, chemical and biological degradation. Again, in the case of the most prominent process – soil erosion by water and wind – a number of activities have been carried out over the past decades. For example, WOCAT identified and analysed over 250 technologies and 50 approaches for a wide range of land uses and bio-physical, social, political and institutional situations world-wide (Liniger H.P. and Critchley W., forthcoming 2006).

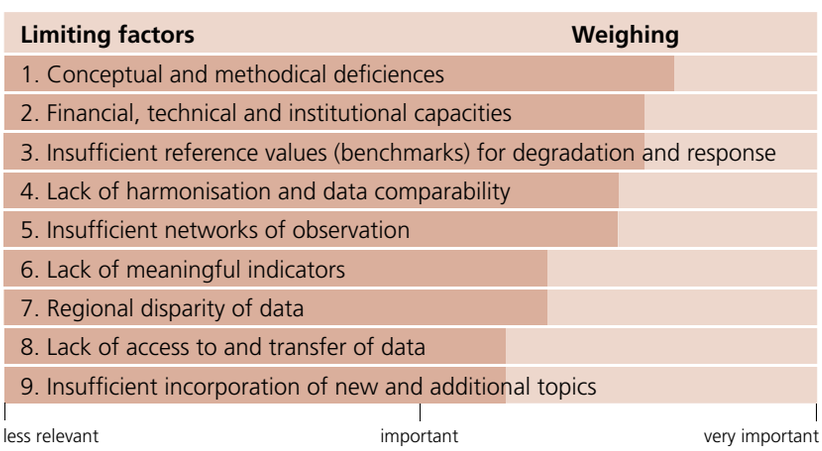


Figure 3: Factors limiting adequate soil monitoring.
Source: World Soils Agenda (IUSS, 2002)

Tasks for policy guidance

Three further tasks in the World Soils Agenda are related to policy guidance (cf. Fig. 4):

Theme	No	Agenda	Target institutions	Source bodies
Policy guidance	4	International, multidisciplinary network	Policy makers, UN agencies, national agencies, NGOs	IUSS, ICSU, ISCO
	5	Intergovernmental panel on soils	Implementing ministries and agencies, decision-support networks, research institutes	INCCD, UNEP, WBGU
	6	Guidance for national soil policies	National, international research and observation agencies	IUCN-ELC

Figure 4: Tasks for policy guidance. Source: World Soils Agenda (IUSS, 2002)

National soil science societies are well represented in the IUSS. Dealing with soil issues, however, requires multiple competences beyond soil science. Sustainable soil and land management is a field that requires the interdisciplinary attention of soil scientists, agronomists, geographers and foresters, as well as economists, sociologists, lawyers, political scientists and others. Identifying and mobilising an international, multidisciplinary network for soils, therefore, is a challenging task that will not be easy to realise. Cooperation among several international unions, e.g. under the auspices of ICSU, was seen as an important task in the World Soils Agenda (Hurni and Meyer, 2002).

A second task in policy guidance was the establishment of an international panel on land and soils (to be called IPLS). Such an advisory body could (a) serve as a clearing house for soil and land-related issues in the UNCCD, (b) synthesise relevant information at the global to local levels, (c) provide information on the impacts of soil and land degradation, (d) provide guidance to scientists on land and soil-related research, and (e) assist in policy-making at all levels in order to achieve sustainable land management (cf. Hurni and Meyer, 2002). As the current level of interest in UNCCD may be rather low, however, the IASUS Working Group has supported the establishment of a World Soils Council under the auspices of IUSS (cf. p. 62).

Finally, providing guidance to develop and implement national soil (and land management) policies was the third task endorsed by IUSS in 2002. In this respect, the Environmental Law Centre of the IUCN was considered most competent to support national initiatives (cf. Hannam, J. and Boer, J., 2004). Legal instruments were assessed for their suitability by the group of specialists in preparation for the World Soils Agenda (cf. Fig. 5).

Instrument	Coverage			Type		Suitability
	Global	Regional	National	Binding	Non-binding	
Framework treaty to strengthen soil in existing treaties	x			x		1.89
National soil law			x	x		2.25
Generic soil law			x	x		2.63
Protocol to existing treaty	x			x		2.78
Special treaty	x			x		2.78
Regional framework treaty		x		x		3.00
Charter or declaration	x				x	3.94

Figure 5: Suitability of legal instruments for sustainable land management. Lowest figure signifies highest suitability. Source: Hurni and Meyer, 2002.

Tasks in support of implementation

The last three tasks of the World Soils Agenda relate to implementation of sustainable land management on the ground (cf. Fig. 6).

A number of development cooperation agencies and national ministries are actively promoting sustainable land management initiatives. The main issue here is how small-scale farmers can be best encouraged to adopt more sustainable land management technologies within their farming systems. Small-scale farmers are the dominant land users both in terms of area coverage and, even more, in number of persons employed in agriculture. Worldwide, nearly 3 billion people are directly dependent on farming, and their range of options and risk-taking opportunities is very

Theme	No	Agenda	Target institutions	Source bodies
Implementation support	7	Programmes to support sustainable land management	Development cooperation agencies	OECD-DAC
	8	Inclusion of soil-related issues in development	Development cooperation agencies	IUSS, WASWC, ISCO
	9	Guidance for national and local action	National ministries, soil associations	UNCCD, UNEP, NRI

Figure 6: Tasks for implementation support. Source: World Soils Agenda (IUSS, 2002)

Far left:
45,000 ha of irrigated land in Tajikistan (of a total of 720,000 ha) are affected by waterlogging problems.
Photo by Hanspeter Liniger

Left:
Soil erosion in an agave culture in Autlán, Mexico.
Photo by Stephan Rist

small because they are the most vulnerable and poorest segment of human society.

Rural development programmes have often not included sustainable land management as an integral component of any activity with small-scale farmers in developing and transition countries. Ensuring that this component is included, and that the impacts of programmes on soil and land resources are evaluated in such programmes, is a task for which international networks such as IUSS, WASWC and ISCO are willing to make specialists and/or task forces available.

The last task is based on the observation that local to national programmes in rural development often do not include soil-related considerations, and that guidance by specialists is needed there as well. Task forces composed of national and international specialists could provide backstopping to implementing bodies such as national ministries or NGOs, in partnership with the groups in charge of action.

Consequences for policies

Development of international mechanisms for sustainable land management must be based on science, strategies and experiences, thereby confronting the challenges posed by the global situation today. These are the four dimensions to be taken into account (cf. Fig. 7).

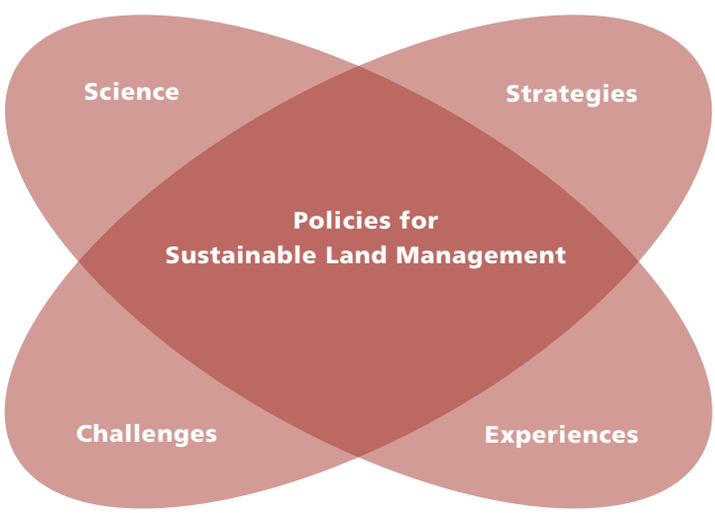


Figure 7: Dimensions to be considered in developing policies for sustainable land management.

The scientific basis for defining policies appears to be adequately established, although much more research is needed to further assess soil and land degradation from the local to the global levels, as a first step towards identifying and assessing the magnitude of the problems and their effects on human society and the ecosystems affected. New land degradation assessments can help improve the situation and serve as an early warning system. In a second step, scientific methods need to be applied to identify suitable measures for reducing and eventually halting soil and land degradation, either by implementing technologies, changing land use systems, or avoiding the indirect impacts of sources of pollution from outside land management.

Strategies for sustainable soil and land management policies have so far primarily been developed for industrialised countries, and to a much lesser extent in developing countries. A good example is the soil protection strategy of the European Union, or Germany with its soil protection law. On a more general level, UNEP developed an ecosystem approach to land use management and soil conservation (UNEP, 2004). Whether an international panel on land and soils is a feasible initiative in support of international conventions such as UNCCD or UNCBD remains to be seen.

Experience is the third and probably most important dimension in developing soil-related policies and addressing the challenge of sustainable land management. Much experience exists, particularly at the local level. Local knowledge, however, has so far not been sufficiently acknowledged, either by the scientific or the political community. Multi-stakeholder involvement in the design of research is a growing methodological issue in research funding, and a practice that is increasingly used in political processes. Experience with conventions and the GEF is accumulating, but still not sufficient to adequately address the issue.

In summary, there are a number of challenges that justify preparing further actions to increase soil-related awareness and activity at the national and international levels. In the context of the issues described above, various specialists from different institutional backgrounds and disciplines have given a number of inputs on existing programmes, strategies and institutions. This formed the basis for an expert panel held during the Eurosoil Congress in Freiburg, Germany, on 9 September 2004, where a first assessment of (a) the need for new policy-relevant mechanisms, (b) the challenge and tasks of new mechanisms, and (c) ways and means to develop and establish such mechanisms was carried out. In a follow-up survey among IASUS Working Group members in 2005, recommendations were made about how to proceed further and initiate action at the regional level. This is reported in Part III of the document.

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Land Degradation Assessment in Drylands – LADA

Michael Stocking

Abstract

Drylands are inhabited by over two billion people, 37 percent of the world's total population. It is estimated that 73 percent of rangelands in drylands are currently being degraded, together with 47 percent of marginal rainfed croplands and a significant percentage of irrigated croplands. The Secretariat and Parties to the UN Convention to Combat Desertification (UNCCD) believe that not enough is known of land degradation and its impacts in drylands in order to develop effective control policies. As a consequence, the Global Environment Facility (GEF) – the major funding body to developing countries to meet the additional cost of measures needed to provide global environmental benefits – designated "land degradation" and "sustainable land management" as focal areas of its global programme to support the UNCCD.

Through the GEF in partnership with FAO, UNEP, the Global Mechanism of the UNCCD and other partners, resources have been provided to develop a full international project entitled Land Degradation Assessment in Drylands (LADA) in order to develop and test an effective assessment methodology. The objectives of LADA are twofold: (a) develop tools and methods to assess and quantify the nature, extent, severity and impacts of land degradation on dryland ecosystems, watersheds and river basins, carbon storage and biological diversity at a range of spatial and temporal scales; (b) build the national, regional and international capacity to analyse, design, plan and implement interventions to mitigate land degradation and establish sustainable land use and management practices.

To achieve these objectives, LADA will develop standardised and improved methods for dryland degradation assessment, with guidelines for their implementation in a range of scales. Using these methods, it will assess the sub-regional and global baseline condition of land degradation with a view to highlighting the areas at greatest risk. These assessments will be supplemented by detailed local assessments that will focus on root cause analysis of land degradation and on local (traditional and adapted) technologies for the mitigation of land degradation. Areas where land degradation is well controlled will be included in the analysis. "Best practice" guidelines will be developed and the results widely disseminated in various media. The project is intended to make an innovative generic contribution to methodologies and monitoring systems for land degradation, supplemented by empirically-derived lessons from the six main partner countries involved in the project – Argentina, China, Cuba, Senegal, South Africa and Tunisia – up-scaled to countries within their regional remit.

http://lada.virtualcentre.org/pagedisplay/display.asp

Far left:
Water harvesting using the half-moon technique in a new olive grove in Syria. Photo by Hanspeter Liniger

Left:
Weeding is labour-intensive but indispensable to achieve good yields. Teff field in the Central Ethiopian Highlands. Photo by Ursula Gämperli

Furthering sustainable land management through the global WOCAT network

G.W.J. van Lynden

Abstract

Both land users and soil and water conservation (SWC) specialists have a wealth of know-how related to land management, improvement of soil fertility, and protection of soil resources. Most of this valuable knowledge however is not documented and evaluated - or if it is, it remains poorly accessible, hindering comparison of different types of experience. This SWC knowledge therefore remains a local, individual resource, unavailable to others working in the same areas and seeking to accomplish similar tasks. This is one of the reasons why soil degradation persists, despite decades of effort throughout the world and high investments in SWC. In this context, WOCAT was founded 1992 as a global network of SWC specialists. It also emerged from the awareness that there has been a heavy focus on documenting soil degradation in the past, but that presentation of SWC and sustainable land management practices – which is much more complicated – has not yet been undertaken in a consistent way.

The WOCAT methodology was originally designed to focus mainly on soil erosion and fertility decline in erosion-prone areas. However, during development and application of the methodology, other land degradation types were included. Additionally, there was a shift from data collection towards evaluation and monitoring, and more emphasis on training and research.

For successful implementation of any sustainable land management (SLM) practice, it is essential to have a proper understanding of the natural and human environment in which a practice is applied. This understanding should not be solely based on the technological details but also include comprehensive information concerning the application of the technologies.

Since 1992 WOCAT has developed through an interactive and participatory process, a standardised methodology for documenting and evaluating soil and water conservation practices worldwide, facilitating exchange and comparison of experiences. Notwithstanding this standardisation, WOCAT allows flexible use of its outputs adapted to different users and different environments. WOCAT has accumulated a wealth of knowledge on sustainable land management in a few hundred case studies world-wide and thus offers a valuable tool for evaluating the strengths and weaknesses of SWC practices and their potential for application in other areas. Besides this wealth of information collected, gaps in available information are also exposed, showing the need for more research in other fields. Several key issues for development-oriented research have been identified.

http://www.wocat.org/

Global assessment of land degradation, and improvement and early warning

David Dent, Michael Schaepman, and Zhanguo Bai

Abstract

Background

There is no measure of the extent or impact of land degradation. The only harmonised global assessment, GLASOD, was an expert judgement compiled in the 1980s - a map of perceptions that cannot be updated. There is continual demand for an up-to-date, quantitative assessment (including land improvement as well as degradation) reproducible by defined procedures, backed up by field measurements of the nature of degradation, and an early warning system: for policy development, investment, and action on the ground.

Global satellite data enable measurements of global changes from local scale to global scales. Biomass is an integrated measure of biological productivity; its deviance from the norm, a measure of land degradation or improvement. It may be assessed by NDVI data from satellites. Regional norms may be established according to climate, soils and terrain; deviance may then be calculated regionally and combined globally.

Objectives

Therefore, a quantitative global assessment of land degradation and improvement (GLADA) is proposed to identify: (1) the status and trends of land degradation; (2) hotspots that are suffering severe degradation; (3) bright spots where the land has been improved. The proposal is part of the UNEP/FAO Land Degradation Assessment in Drylands (LADA) programme that will follow up with a participatory approach to come to grips with local and national issues. Ongoing monitoring, using GLADA as a baseline, will provide early warning of increasing degradation in specific areas.

Procedure

1. Remote sensing of biomass and measurement of deviance from local norms – negative deviation measures land degradation; positive, land improvement;
2. Field investigation to identify the nature and measure the magnitude of degradation and improvement; guided by interpretation of satellite imagery and all other available information;
3. Scenario modeling for policy support and management - for instance, quantifying biophysical, economic and social risks associated with degradation in specific areas; implications for biodiversity; forest, rangeland and farmland productivity.
4. Monitoring and early warning, using subsequent overflights.

Note: A full version of this project idea is available from ISRIC, Wageningen.

Far left:
Rock catchment for water harvesting in Kenya.
Photo by Hanspeter Liniger

Left:
The ecosystem approach: integrated soil, water and vegetation management in Mindanao, Philippines.
Photo by Karl Herweg

The ecosystem approach in land use management and soil conservation

Jens Mackensen

Abstract

Land and soil resources are a relevant part of our global life support system. The loss and degradation of land and soil resources need to be seen in the context of policy, socio-economic conditions, and the environment. The UN Millennium Declaration, the UN Millennium Development Goals, and the Plan of Implementation of the World Summit for Sustainable Development call for maintenance of the integrity and restoration of land resources as a critical factor in achieving economic and ecological sustainability. In order to meet these challenges, new and innovative approaches are required.

Key issues related to this challenge include inter alia (a) the extent of land degradation, (b) poverty being both the cause and effect of land degradation, (c) land tenure and public participation, (d) environmental impacts of agriculture, (e) water and land use management, (f) environmental emergencies, (g) urbanisation, (h) climate change and (i) trade and environmental externalities.
The prevention and mitigation of land degradation through the promotion of sustainable land management is a global challenge with a local focus. To address the identified key issues in land use management and soil conservation within a development-oriented approach poses challenges to all stakeholders and requires integrative solutions across the policy, socio-economic, and environmental sectors. UNEP in particular is challenged to address the environmental dimensions of land use management and soil conservation as relevant to the overall objectives of sustainable development and poverty reduction.

In its recently published strategy for land use management and soil conservation UNEP suggests applying the Ecosystem Approach as developed under the CBD to land and soil-related matters.

The Ecosystem Approach relates to relevant levels of biological organisation, which encompasses the essential structure, processes, functions and interactions among organisms and their environments. It recognises that humans, with their cultural diversity, are an integral component of many ecosystems.

The Millennium Ecosystem Assessment fully incorporates the Ecosystem Approach by highlighting the role of the provisioning, regulating, cultural and supporting services of ecosystems, including land and soil resources, for human well-being.

The Ecosystem Approach as an overall methodological framework for supporting decisions in policy-making and planning provides 12 principles and guidelines for implementation (see UNEP/CBD/COP/7/L.14, 18th February 2004). The applicability of these principles and guidelines to land use and soil conservation issues in a regional or national context still needs to be assessed.

The Thematic Strategy for Soil Protection of the European Commission

Luca Montanarella

Introduction

Soil protection has never ranked high among the priorities for environmental protection in Europe. Soils are commonly not well known to European citizens, particularly since only a small fraction of the European population currently lives in rural areas and has direct contact with soils.
The majority of the urban population in Europe has only little understanding of the features and functions of soils. The most common perception is usually that soils are a good dumping site for all kinds of wastes and that soils can be quite useful as surfaces for building houses and infrastructure. Only during the last 2-3 years has the need for a coherent approach to soil protection found a place on the political agenda in Europe. It was therefore introduced as one of the thematic strategies to be developed within the Community's 6th Environment Action Programme (6th EAP). The rationale behind the development of a coherent approach to soil protection is based on the recognition of the multi-functionality of soils. Soils are no longer considered only as dumping sites, construction surfaces or a means of production (agriculture) but also as a fundamental environmental component that performs vital ecological, social and economic services. These include filtering and buffering of contaminants, allowing us to have clean drinking water, a pool of biodiversity, raw materials, a sink for atmospheric carbon dioxide, an archive of cultural heritage, etc. These functions are now recognised as being equal in importance to the traditional soil functions commonly attributed to soils: production of food, fibre and wood (agriculture and forestry) and surfaces for housing and infrastructure (spatial development).

In order to develop a soil protection policy it is important to recognise that soils have distinctive features that make them quite different from other environmental components such as air and water. Soils are first of all highly diverse, both in space and time. Soil properties can be completely different for soils only a few meters apart. The development of a common soil map of Europe has helped describe the very high spatial variability of soils across the European continent (cf. Fig. 8). Soils are not static but develop over time. The timescale for these changes is usually very long (hundreds of years). Therefore, for policy-making purposes, we consider soils as essentially a non-renewable resource. The great variability of soils implies that any soil protection strategy needs to have a strong local element built in. It is at the local level that we can act in specific ways that are appropriate to the features of these particular soil types. This of course brings up the important distinction that needs to be made in identifying the actors that must develop and implement soil protection measures. It should be recognised that, while there are important local elements that need to be built into any soil protection strategy, there are nevertheless clearly identified off-site effects of soil degradation that justify a European or even a global approach to soil protection. Erosion, decline of organic matter, soil contamination, soil compaction, soil sealing, and loss of biodiversity have very important off-site consequences, such as silting of hydropower stations, increase of atmospheric carbon dioxide, contamination of drinking and bathing water, contamination of food, increased frequency of flooding and landslides, etc. All these off-site effects seriously threaten human health and have substantial economic implications.
A key feature in developing a soil protection strategy is the recognition of these implications, linked with the fact that soils in Europe are commonly subject to property rights. The majority of soils are on private property, and this brings up a series of environmental liability implications.

Far left:
Rill erosion in winter wheat in early spring due to inadequate soil cover, Switzerland.
Photo by Thomas Ledermann

Left:
Green manuring in this viniculture in the Toscana, Italy, provides enough soil cover to absorb most of the energy from raindrops.
Photo by Karl Herweg

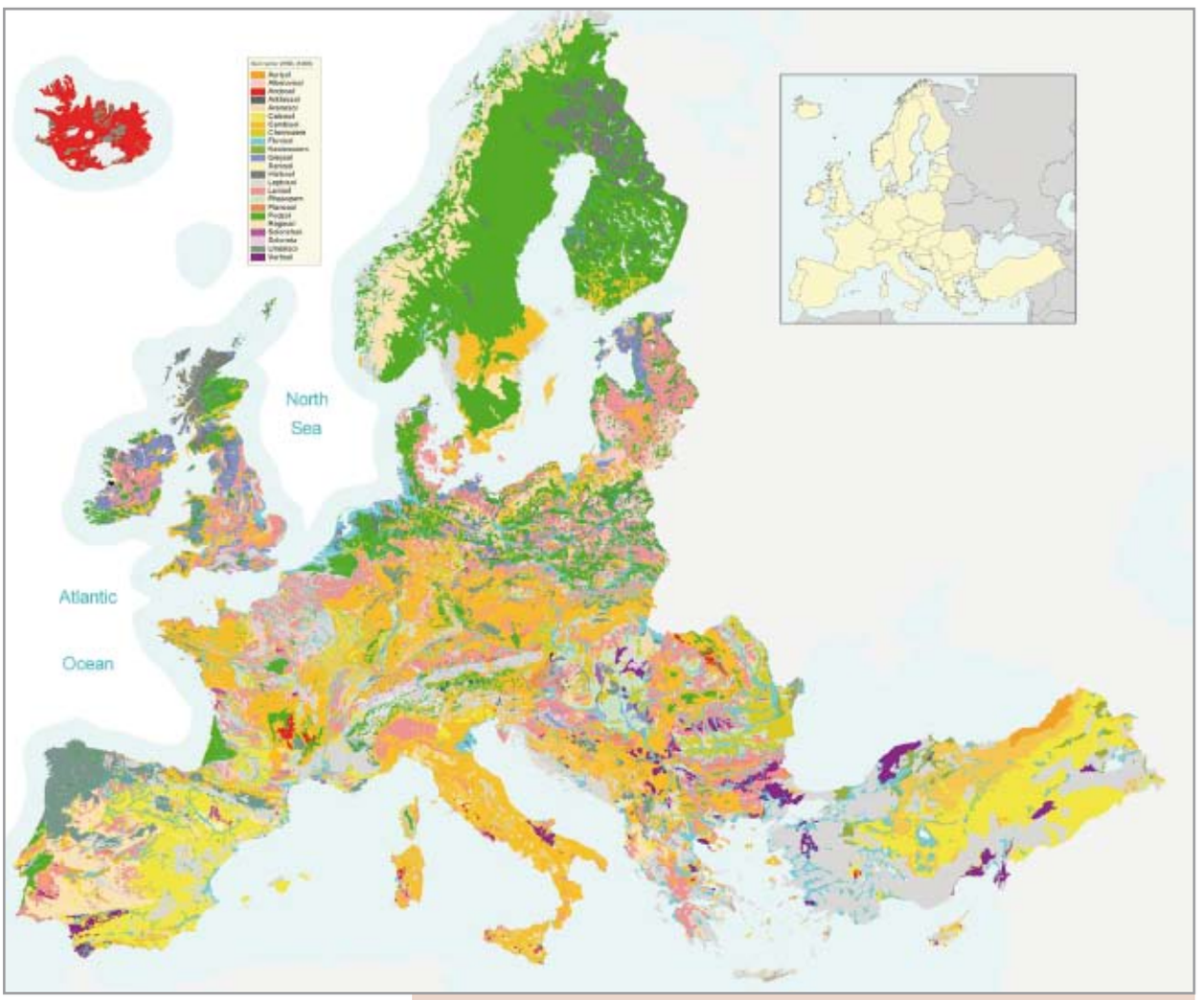

Figure 8: Soil map derived from the Soil Geographical Database of Europe at a scale 1:1,000,000.

The EU soil protection strategy builds on the recognition that severe degradation processes threaten the important functions of soils. The major threats identified so far are soil erosion, decline in organic matter content, loss of soil biodiversity, soil contamination, salinisation, soil compaction, soil sealing, and major hydrogeological risks (floods and landslides). A detailed analysis of these threats and their extent in Europe is available elsewhere (Jones et al., in press). In this paper we will focus on possible actions and policies for protecting European soils from these threats.

The international context

There is currently no single binding multilateral agreement at global level dealing specifically with soil protection. There have been some attempts to develop initiatives towards a global soil convention (http://www.soil-convention.org/english.htm) by some private organisations and NGOs, but no formal step has been taken so far in this direction by any country.
Many aspects of soil protection are already covered by the existing multilateral environmental agreements (MEAs). The United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention on Biodiversity (UNCBD and the United Nations Convention to Combat Desertification (UNCCD) are already dealing with soil-related issues.

At the core of these conventions is the soil organic carbon pool, one of the major global carbon pools (estimated 1500 Pg) and therefore highly relevant to the UNFCCC. But soil organic carbon is also the major precondition for life in soils, and therefore there is a close link between soil organic carbon levels/quality and biodiversity in soils. This aspect therefore directly concerns the UNCBD. Finally, soil organic carbon is a good indicator of desertification processes, since it is closely linked to temperature and humidity. Therefore there are a number of implications within the UNCCD process.

The challenge posed by the intricate relationships of climate, biological diversity, drought and desertification on the social, economic and environmental fronts in many countries has been exemplified in recent times. It has also been amply demonstrated that there is a clear convergence of objectives among the three Rio Conventions, the United Nations Convention to Combat Desertification (UNCCD), the Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC). Parties to these Conventions have repeatedly pointed out that there is a need for a firmer convergence of the strategic approaches the various interested parties, particularly at the individual country level, have hitherto pursued. Moreover, the need is also recognised for Parties to focus more on a broader framework that includes a complex set of issues encompassing desertification and land management, biological diversity, climate change, and socio-economic development, among others. In particular, in order to address more concretely the intertwined issues of poverty eradication, sustainable development and environmental security, the three Rio Conventions have expressed the need to join efforts in order not to address these issues separately.

In order to further strengthen the links between the three Rio Conventions, a specific workshop was organised by the Italian Government from 5-7 April 2004 in Viterbo, Italy, entitled "Forests and Forest Ecosystems: Promoting Synergy in the Implementation of the Three Rio Conventions". The proceedings are available at http://www.unccd.int/workshop/menu.php.

A similar initiative is also urgently needed for soils and could be the first step towards a more coherent approach to

Far left:
No-tillage for crops – a component of conservation agriculture in Switzerland – is being increasingly applied in Europe.
Photo by Thomas Ledermann

Left:
A farmer's machine for direct seeding practice. Switzerland.
Photo by Flurina Schneider

soil protection at the global level. The IASUS initiative of IUSS could play a key role in this respect in the future.

The EU Thematic Strategy for Soil Protection

Soil protection in Europe has been only recently introduced in the agenda of the European Union. The 6th Environmental Action Programme published by the Commission in 2001 established the objective of protecting soils against erosion and pollution while the Sustainable Development Strategy, also published in 2001, noted that soil loss and declining fertility are eroding the viability of agricultural land. It calls for the establishment of a thematic strategy on soil protection, with particular attention to preventing erosion, deterioration, contamination and desertification.

As a follow-up, the European Commission presented the communication "Towards a Thematic Strategy for Soil Protection" in 2002. The purpose of that Communication was to build on political commitment in order that soil protection be achieved more fully and systematically in coming years, by outlining ways of developing this strategy. However, this Communication was also the first occasion on which the Commission addressed soil protection for its own sake and therefore it is both broad and descriptive in approach. It addresses inter alia erosion, the decline in soil organic matter, and prevention of pollution. It aims in particular to:

- describe the multiple functions of soils
- identify their characteristics relevant to policy development
- identify the main threats to soils
- present an overview of relevant Community policy
- present the current situation about soil information and monitoring, and identify gaps that need to be filled as a basis for a soil protection policy
- establish the policy basis and outline the steps towards presentation of a thematic strategy on soil protection in the near future.

The communication introduces for the first time a number of fundamental concepts for a future soil protection strategy in Europe:

1. Soils need to be protected to preserve their multi-functionality. Therefore the traditional view of soils as being exclusively in the realm of agriculture because of their role in production is integrated with recognition of the multiple functions soils perform for society (filtering and buffering of contaminants, source of biodiversity, source of raw materials, repository of cultural heritage, etc.). Therefore soil protection needs to be addressed as a cross-cutting issue in a number of policy areas: environmental policy, agricultural policy, spatial planning, etc.
2. Soils are highly diverse in space, and therefore should be primarily protected through local measures suitable to the peculiarities and properties of the local soil conditions. There is no point in setting identical standards across the EU if we want to preserve the rich diversity of soils in Europe.
3. Soils are a limited, non-renewable, resource. Over long periods of time (thousands of years), soils can regenerate, but for policy-making purposes soils are considered non-renewable. We therefore need to assure that this precious resource is also available for future generations.
4. Soils are subject to property rights. This implies that there are environmental liability issues that need to be taken into account, particularly in relation to the off-site effects of soil degradation.

A clear distinction has to be made between soil and land. Soils are considered here as a multi-functional, tri-dimensional entity. Land is mainly considered a bi-dimensional surface integrating a number of spatial features (landscapes, vegetation, housing, etc.). No attempt is made by the EU Soil Protection Thematic Strategy to enter into the domain of spatial planning and land use issues dealt with in other policy areas.

A number of threats are endangering the soil resources of Europe:

1. Soil erosion by water and wind
2. Decline of soil organic matter
3. Soil contamination (local and diffuse)
4. Soil sealing by infrastructure and housing
5. Soil compaction
6. Decline in soil biodiversity
7. Salinisation
8. Floods and landslides

Action needs to be taken in order to reverse the trend towards widespread soil degradation in Europe.

Who should take action? According to the subsidiarity principle and to the strong local dimension of soil degradation, action should be taken locally. As explained above, soil diversity requires tailoring specific soil protection measures to local conditions. Nevertheless, there is also a national and EU dimension to soil protection.

Local communities need to be placed in the appropriate enabling environment, creating the pre-conditions for soil protection. Many EU policies are heavily influencing the ways soils are managed at a local level.
First of all the Common Agricultural Policy (CAP) is the single most important policy instrument influencing how farmers manage their soils. It accounts for nearly half of the total EU budget and can provide the necessary incentives for promoting actions towards soil protection. The recent mid-term review of the CAP has further enhanced the aspects related to sustainable agriculture and good farming practices, specifically mentioning soil erosion, decline of soil organic matter and loss of soil structure (compaction) as criteria to be taken into account when defining good farming practices. Implementation of this revised CAP will have to prove that such measures effectively contribute to the reduction of soil degradation within the EU.

Another EU policy area that strongly influences some aspects of soil protection is waste policy. Waste management is a key element in preventing soil contamination. Most directly linked is the Sewage Sludge Directive that regulates the use of sewage sludge in agriculture in such a way as to prevent harmful effects on soil.
In more general terms the Waste Framework Directive requires that waste be disposed of without endangering the soil. Further specific waste legislation such as the Landfill Directive, the Incineration Directive and the Urban Wastewater Directive may contribute to the prevention of soil contamination.

Community legislation on water (Nitrates Directive and Water Framework Directive) sets standards for preventing the contamination of surface and groundwater by the leakage of hazardous substances or excessive nutrients from soils. The Nitrates Directive places emphasis on the establishment of good farming practices in all areas and on action programmes in nitrate-vulnerable zones. It includes provisions to improve soil conditions, such as winter cover crops and adjusted soil management in areas with steep slopes. The Water Framework Directive aims to secure the quantitative and qualitative functions of water, including ecological functions. It requires that all impacts on water be analysed and actions taken within river basin management

Far left:
Old and abandoned deposits of sometimes toxic waste, like this one in Greenland, are one of the key problems to be resolved in Europe.
Photo by Silvia Lazar

Left:
Rotary band seeding of maize in a grass cover crop, Switzerland.
Photo by Volker Prasuhn

plans. Wherever contaminated soils, erosion or excessively fertilised soil contribute to surface or groundwater contamination, the necessary remedial action will in many cases lead to improved soil protection.

There are several other legislative areas that affect soils. Nevertheless, up to now, no coherent approach has been developed by the EU for soil protection. The EU Thematic Strategy for Soil Protection will define the approach chosen by the EU and should also identify the major actors that need to take action in order to implement successful soil protection in Europe.

Conclusions

A coherent approach to soil protection in Europe is just beginning. The goals set out in the communication "Towards a Thematic Strategy for Soil Protection" will take time to be achieved and will need further steps, as outlined in the final conclusions of the Council on this Thematic Strategy. An efficient soil information system capable of giving answers to the questions raised by policy makers is a key requirement before any further action can be effectively undertaken. Soil information is available in Europe. Unfortunately a lot of this information is scattered in different institutions both at National and at European level. The proposal for a common approach to soil monitoring that the Commission put forward in 2005 addresses this problem and proposes solutions that take into account the existing soil information systems and propose a framework allowing for exchange of data in a harmonised way across the EU.

In the longer term, the availability of policy-relevant soil information will allow efficient implementation of the measures necessary to achieve soil protection for sustainable development in Europe. Soil conservation can best be achieved through participatory approaches involving all current stakeholders. Sound conservation strategies require a solid scientific and technical background. The substantial achievements of the US Soil Conservation Service in reversing the negative trend and actually improving soil conditions in the US demonstrate that effective soil conservation is achievable through voluntary approaches. But good will is not sufficient; a background of scientific knowledge is also required, along with an infrastructure to transfer this knowledge to stakeholders and, last but not least, substantial economic resources to sustain soil conservation efforts in the long term.

All these elements are still to be defined in the EU Thematic Strategy for Soil Protection. An initial framework has been given by the recent revision of the Common Agricultural Policy that puts soil protection at the centre of good agricultural practices. Implementation of these practices will nevertheless require technical guidance and scientific support. Unfortunately there is no EU-wide approach to the implementation of soil conservation through technical extension services. Some EU Member States have developed services comparable to the US Soil Conservation Service. Nevertheless, there is a lack of common EU guidelines and technical manuals to assure implementation of soil protection through harmonised approaches across the European Union. These issues should be addressed in the final definition of the EU Thematic Strategy for Soil Protection.

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Rain-fed cultures on upper hillside, irrigated vegetable gardens on lower hillside, and irrigated rice fields at the bottom, representing acculturation over generations. Highlands of Madagascar. Photo by Ursula Gämperli

Soil and land in the Millennium Ecosystem Assessment and the Rio Conventions

Markus Giger

Introduction

An overview – based on material available on the relevant Internet sites – was undertaken in preparation for the Eurosoil Congress. The aim was to prepare the ground for the subsequent panel discussion on new mechanisms to support sustainable land management. The overview focused on the following basic question: How are soil and land issues addressed in the Millennium Ecosystem Assessment and in three important UN-Conventions (UNCCD; UNFCCC; UNCBD)?
The basic features of these important international processes and mechanisms and their relevance for soil and land issues were explored. Specifically, the following points were addressed:

- In what terms and with which concepts do these mechanisms address soil and land issues?
- What potential do they have to advance sustainable land management (SLM) based on inputs from science? What deficiencies, if any, can be observed?
- What efforts are currently being made to improve the synergies between these mechanisms?

Millennium Ecosystem Assessment

The Millennium Ecosystem Assessment (MA) is an international work program designed to meet the needs of decision-makers and the public for scientific information concerning the consequences of ecosystem change. The direct objectives of the MA are:

1. Systemisation of the existing assessments (conditions and trends),
2. Demonstration of the potential of ecosystems for poverty reduction, and
3. Evaluation of response options.

The MA is expected to meet the assessment needs of CBD, UNCCD, the Convention on Wetlands (Ramsar) and the Convention on Migratory Species (CMS).

Land issues are addressed through an ecosystem approach (dryland, forest, and mountain systems, inland waters, coastal and marine systems). The MA does not focus on soil or land per se, but its concept looks at the status and trends of ecosystem services. Conversely, land management, depending on the definition used, is indeed covered to some extent, through assessment of different ecosystems and their services.

Soils are therefore addressed in relation to the services they provide for human well-being and poverty reduction. In summary, the MA reports that more than 60% of ecosystem services have been degraded or used unsustainably (MA, 2005). The MA distinguishes among provisioning, regulating, cultural, and supporting services. Services related to soils therefore fall into all of these categories. The MA concludes that many provisioning services (e.g., food, livestock and fibre production) have increased tremendously over the last fifty years, which has helped to improve the lives of billions of people. However, many regulating and supporting functions have been degraded, and this is endangering the achievements of the Millennium Development Goals. The MA clearly advocates the need for far-reaching responses from decision-makers if the degradation of these ecosystem services is to be reversed.
Concretely, soil issues are taken up mainly in relation to the assessment of nutrient cycles, soil formation, erosion regulation, water regulation, and natural hazard regulation. However, compared to other questions such as biodiversity, soil issues are not dealt with very prominently in the report, and it is not expected that very significant new knowledge will be made available with regard to the status of soil resources.

United Nations Framework Convention on Climate Change

Land and soil issues are addressed in the UNFCCC, albeit predominantly indirectly in terms of objectives related to forestry and agriculture. In Article 4, all parties commit themselves (inter alia) to reducing and preventing greenhouse gases in all relevant sectors, including agriculture and forestry; to promote and cooperate in the conservation and enhancement of sinks and reservoirs in terrestrial systems; to prepare for adaptation to the impacts of climate change; to develop integrated plans for water resources and agriculture; and to protect and rehabilitate areas, particularly in Africa, affected by drought and desertification as well as floods.

The Kyoto Protocol foresees a relevant instrument, the Clean Development Mechanism. Concrete links to land use questions can be found, in particular to forest, cropland, and grazing land management, and revegetation. Presently the emphasis is mainly on forestry. However, the sustainability of a solution that relies on forests remains questionable, given the limited time horizon of carbon storage in forests. There is room to include carbon sequestration in soils in activities under the convention. Examples are reduced methane (CH_4) emission through improved manure management, different diets for livestock, adapted irrigation of rice, and lower laughing gas (N_2O) emissions from reduced use of chemical fertilisers. However, many procedures and methodologies in the Kyoto Protocol related to these issues have not yet been developed (Dutscke, 2005).

Clearly, CO_2 sequestration in soils is an issue that has not yet been fully explored and highlighted in the policy arena, although there is a clear need for this: "Agricultural soils are a net source of carbon dioxide - but they could be made into a net sink. As much as 400–800 million tons of carbon could be taken up by agricultural soils every year through improved management practices designed to increase agricultural productivity (UNDP, 1997, quoted in UNCCD, 2004). Among the strategies advocated are the use of low- or no-tillage practices, returning more crop residues to the soil; introducing perennial crops; and in temperate regions, increased use of animal manure.

Convention on Biological Diversity

The CBD addresses the land issue mainly through the ecosystem approach. Soil biodiversity is only beginning to be addressed by in-depth research, and a special work programme on soil biodiversity has been launched by the CBD (see contribution by Michael Stocking in this publication).

United Nations Convention to Combat Desertification

Of all the conventions, the UNCCD currently addresses soil issues most directly. However, it is not a global soil convention, since it aims to combat desertification and mitigate drought. It focuses on specific, albeit very large regions of the world. According to the UNCCD definition, desertification "means land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities". Nevertheless, UNCCD says: "Recognising the work that remains to be done in raising the profile of soil conservation, the Convention provides the structure and an enabling framework for affected countries to work with land management experts to develop sustainable land use practices to conserve topsoil" (UNCCD Secretariat, 2004). National Action Programmes are one of the key instruments in the implementation of the Convention, and these programmes address soil and land management issues. As of 2005,

Far left:
Efficient water use in the dry highland area of Wadi Dar, Yemen.
Photo by Hans Hurni

Left:
The Sahara has expanded by more than 10 percent in the last century. Sandstorm in Niger.
Photo by Hanspeter Liniger

77 National Action Programmes had been prepared and adopted. These instruments are considered core references in an ongoing process of planning for poverty reduction and the sustainable development of drylands (UNCCD Fact sheet 4, 2004). UNCCD highlights the need to integrate efforts to combat desertification into other development programme frameworks. Programmes are expected to outline long-term strategies, and are formulated with the participation of local communities. These aspects are essential to provide ownership and continuity for long-term programming.

UNCCD's Committee on Science and Technology (CST) serves as a subsidiary body of the Conference of the Parties (COP). Its role is the provision of information and advice on scientific and technological matters relating to combating desertification and mitigating the effects of drought. The CST is composed of government representatives competent in the fields of expertise relevant to combating desertification and mitigating the effects of drought.

Since 2002, the Global Environmental Fund has served as the official financial mechanism for UNCCD. It has developed an operational programme (OP 15) on sustainable land management. Between 2002 and 2004, the GEF funded more than $72 million worth of projects focused primarily on combating deforestation and desertification. Obviously, the land degradation issue also cuts across the other focal areas of GEF, particularly biodiversity and climate change (see contribution by Anna Tengberg in this publication).

Synergies between the conventions

Synergies between the conventions should be built on the basis of the many obvious direct and indirect links between carbon capture in degraded lands, adding value to and enhancing biodiversity in ecosystems, sustainable management of soils, and efficient and sustainable use of energy from biomass and other non-fossil sources.

The need for improved linkages and cooperation was identified several years ago (Herold et al., 2001). A joint liaison group for the three Rio Conventions was created in 2001, and a number of activities (workshops) have highlighted the potential for synergies between the conventions. UNEP has created a Division of Environmental Convention, with the mission of identifying synergies and promoting substantive collaboration among Multilateral Environmental Agreements.

The establishment of the GEF as a financial mechanism for UNCCD makes it possible to develop more credible synergistic programmes that foster new partnerships between actors at different levels and from different sectors. Even if the role of sustainable land and soil management is not obvious in the formulation of the convention, is it nevertheless a basic condition for sustainable development, and a starting point from which synergies can be built among the conventions (Ott, 2005).

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Funding sustainable land management through the Global Environment Facility

Anna Tengberg

Abstract

GEF funds activities that address six focal areas of climate change, biological diversity, international waters, depletion of the ozone layer, land degradation and persistent organic pollutants (POPs). Land degradation and POPs were designated as focal areas by the GEF Assembly in Beijing in October 2002. This was followed by the adoption of an Operational Programme on Sustainable Land Management (OP15) that provides guidance on sustainable land management activities eligible for GEF funding. GEF is to operate on the basis of collaboration and partnership among the GEF implementing agencies (United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP) and the World Bank) as a mechanism for international co-operation, with the purpose of providing new and additional grant and concessional funding to meet the agreed incremental costs of measures to achieve global environmental benefits in the six focal areas.

The GEF supports country-driven activities aimed at preventing and/or controlling land degradation, particularly desertification and deforestation, through its focal area on land degradation and through the interface with the biodiversity, climate change and international waters focal areas. The objective of GEF's OP15 on sustainable land management is to mitigate the causes and negative impacts of land degradation on ecosystem stability, functions and services through sustainable land management practices, as a contribution to improving people's livelihoods and economic well-being. Support can be provided for sustainable land management activities with regard to:

- Capacity building, including mainstreaming of sustainable land management into national development priorities; integration of land use planning systems; agreements and mechanisms for management of transboundary resources
- On-the-ground investments in sustainable agriculture, sustainable rangeland/pasture management, and forest and woodland management
- Targeted research in order to better understand the policy and institutional failures that drive land degradation, and to facilitate the refinement and adoption of innovative sustainable land management practices and technologies, including early warning and monitoring systems.

Activities addressing land degradation are also funded as cross-cutting issues through several Operational Programmes of the GEF under the biodiversity and international waters focal areas.

This presentation will focus on UNEP's portfolio of projects that address land degradation, either directly under the land degradation focal area or indirectly as a crosscutting issue under other focal areas. UNEP's support for sustainable land management within the context of the GEF revolves around the following themes: (a) Capacity building; (b) Environmental assessment and research; (c) Tools, methodologies and best practices for sustainable land management; and (d) Sustainable land management in transboundary ecosystems. The presentation will provide an overview of the current UNEP/GEF land degradation portfolio highlighting projects that demonstrate new and innovative approaches to sustainable land management and synergies with the other GEF focal areas. Finally, some conclusions will be drawn regarding the need for a new global mechanism to promote sustainable land management.

Far left:
Sedimentation behind a contour stone bund in Gujarat, India.
Photo by Will Critchley

Left:
Land structures of small-scale farming: Contour bunds established by grasses from a previous large-scale farming system. North of Mount Kenya.
Photo by Hanspeter Liniger

Soils and land management – the role of the Convention on Biological Diversity and the CBD/FAO Soil Biodiversity Initiative

Michael Stocking

The 17th World Congress of Soil Science highlighted the concern that soil and land degradation remains a largely unresolved problem of global environmental change and called for greater attention to this issue at the intergovernmental level. This paper outlines the interest and activities related to soils and land management under one of the existing international instruments – the Convention on Biological Diversity (CBD). Soil biodiversity has been identified as an area requiring particular attention under the Convention through the International Soil Biodiversity Initiative which is coordinated and led by the Food and Agriculture Organisation of the United Nations. In this contribution, firstly the importance of soil biodiversity, especially in terms of the ecosystem goods and services it provides, is outlined. Then the International Soil Biodiversity Initiative and other initiatives under the Convention are reviewed, including the Ecosystem Approach and cooperation with the UN Framework Convention on Climate Change and the Convention to Combat Desertification.

Soil Biodiversity and Agriculture

Soil Biodiversity: provider of essential ecosystem goods and services

Soil organisms contribute to a wide range of essential services and are critical for the sustainable functioning of all terrestrial ecosystems. They act as the primary driving agents of nutrient cycling, regulating the dynamics of soil organic matter, soil carbon sequestration and greenhouse gas emission; modifying soil physical structure and water regimes, enhancing the amount and efficiency of nutrient acquisition by the vegetation, and controlling pests and diseases. The services they provide constitute an important resource for the sustainable management of agricultural systems, contributing to the sustained provision of food, sustainable livelihoods and human well-being.

It is the overlooking and hence depletion of the beneficial soil biological functions performed by soil organisms in terrestrial ecosystems that contributes, amongst other factors, to increased rates of land degradation, nutrient depletion, fertility decline, water scarcity, crop productivity and yield reductions.

To date, information related to the ecosystem services and to the derived benefits of the biological functions performed by soil organisms is still scarce in the literature. There are various reasons that include the difficulty of analysing these processes and assessing their economic contributions. Efforts are thus rather urgent to include this subject in the policy agenda regarding global analysis of environmental services and benefits provided by soil organisms in both natural ecosystems and agro-ecosystems.
There are thus agronomic, socio-economic, ecological and ethical reasons for promoting increased attention to soil biodiversity management and conservation:

- Ecologically, soil biota is responsible for regulating several critical functions in soil. Land use and management practices that negatively affect these soil biological functions are contributing, amongst other factors, to land degradation, fertility decline, water scarcity, and severe decline in agricultural productivity and thereby food security.
- Soil fertility and agricultural productivity depend on air, nutrient and water cycles as well as on soil structure, which are all closely linked with soil biota and the processes they regulate.

- Excessive reduction in soil biodiversity, especially the loss of keystone species or species with unique functions may have catastrophic ecological effects leading to the long-term deterioration of soil fertility and the loss of agricultural productive capacity.
- All ecosystems and human societies depend on a healthy and productive natural environment that contains diverse plant and animal species. Losses in biodiversity have been escalating with the growing encroachment of human activities on ecosystems and increasing intensification of land use to meet demographic and socio-economic pressures.
- There are important links between above ground and below ground biodiversity and the services they provide. The root zone is the site of complex soil - plant - nutrient interactions and processes, and many insects including pollinators and natural enemies of pests spend part of their life cycle in the soil.
- The economic benefits of "ecosystem services" provided by soil biological functions are enormous but largely neglected. Some estimations have been made, however, the benefits are difficult to assess without advances in understanding and recognition of the complex processes and above-below ground interactions and their benefits to individual land users, communities and the wider public and to global environmental processes.
- A comprehensive economic analysis of soil biological management and soil biodiversity will not be realistic until a better understanding of the issues and priorities has been obtained. However, a number of useful case studies might be available in the near future if concerned institutions and initiatives provide their results.
- The analysis of biodiversity and its management is heavily influenced by the perspective used. In particular different sectors of society attribute different values to biodiversity. In order to express the benefits of the wide range of services provided by ecosystems, in general the utilitarian approach is used which applies monetary terms (see Millennium Ecosystem Assessment final report, chapter 6). This focus on utilitarian, or direct use value of components of biodiversity, neglects other recognised types of value of biodiversity: intrinsic (cultural, social, aesthetic, and ethical benefits), and option values (potential future value, currently unknown).

Soil biodiversity is vast .... and largely uncharted

Soil biodiversity reflects the variability among living organisms in the soil – ranging from the myriad of invisible microbes, bacteria and fungi to the more familiar macro-fauna such as earthworms and termites. Plant roots can also be considered as soil organisms in view of their symbiotic relationships and interactions with other soil components.

Soil is one of the most diverse habitats on earth and contains one of the most diverse assemblages of living organisms (Giller et al., 1997). Nowhere in nature are species so densely packed as in soil communities (Hågvar, 1998). Soil ecologists have pointed out that soil might contain many more species than initially expected, and may therefore represent a new biotic frontier, together with the tropical forest canopy and deep sea areas. Soil biota includes micro-organisms (bacteria, fungi, etc.), micro-fauna (protozoa, nematodes, etc.), meso-fauna (acari, springtails, etc.) and macro-fauna (insects, earthworms, etc.). It also includes the roots that grow in the soil and interact with other species above and below ground. A rapid survey of invertebrate and vertebrate groups reveals that at least 25% of the described living

Far left:
Soil biodiversity and well aerated humus, indicated by high earthworm frequency. A-horizon of a Cambisol near Bern, Switzerland.
Photo by Ursula Gämperli

Left:
Healthy soil is a living body made up of inorganic material, decaying organic matter, water, air, and billions of living organisms.
Photo by Silvia Lazar

species are strictly soil or litter dwellers. This prodigious diversity of the below-ground component of biodiversity has led to proposal of the issue of the "enigma of soil diversity" (Anderson, 1975), or why there is such a large number of species that apparently coexist in the soil without biotic mechanisms that reduce diversity, for example, competitive exclusion process (Wardle, 2002). A set of proper concepts and ecological theories are proposed to explain this pattern (Swift, 1979; Lavelle and Spain, 2001).

Despite its supposedly critical contribution to global diversity, soil fauna has received comparatively little scientific attention when compared with other groups such as higher plants and vertebrates. In many groups, there is still little knowledge to date or an imbalance in our knowledge of tropical and temperate species; reasons why the soil community has been referred as the "Poor man's rainforest" by Giller (1996).

Sustainable land management is key to the conservation of soil biodiversity

Soil biodiversity and agriculture interact in various ways. Soil organisms may be beneficial or detrimental to plant production and health. Agricultural practices usually induce some changes in the soil environment, resulting in modifications of the composition and interactions of these organisms. Different land use and management practices have significant positive and negative impacts on the composition of soil biological communities and their functions. Integrated soil management aims to minimise the negative aspects and enhance the beneficial effects of soil biota through direct interventions on soil biota, such as inoculation, and indirect interventions that affect the activities of soil organisms, such as mulching, tillage, irrigation and crop rotations.
An integrated approach to agriculture is encouraged that enhances the biological efficiency of soil processes and their contribution to soil fertility, productivity, and crop protection, as well as reducing the risk of degradation, drought and flood through protecting the soil and maintaining the hydrological regime. While of use in modern commercial agriculture to improve soil health and resilience and reduce costs, soil biological management is of major importance in regions where high external input agriculture is not feasible, including in marginal lands to avoid degradation and for the restoration of degraded lands.

The goods and services provided by soil biodiversity are of particular importance to developing countries, where people cannot afford sustained technical inputs for soil improvement such as use of pesticides, artificial fertilizers and soil amendments. Moreover, it has been shown that conventional agriculture relying on tillage and external inputs to enhance productivity may result in greater ecological disturbance, and may be less sustainable in the long term compared to low external input agricultural (LEIA) and/or zero-tillage systems. There are many approaches to sustainable agriculture with the goal of reducing environmental degradation, through appropriate technologies or management practices. Among these, organic agriculture and conservation agriculture are being widely adopted and developed for commercial farming as well as for land reclamation or rehabilitation and food security purposes. There have been few serious efforts in assessing the value of ecosystem services, with the exception of cost-benefit analysis of on-farm and off-

farm effects of soil erosion and land degradation (Crosson 2003, Lipper 2001). Pimentel et al. (1997) using macroeconomic theory, estimated that the ecosystem services provided each year by soil biota in agricultural systems worldwide (e.g., organic waste disposal, soil formation, N_2 fixation, bioremediation and biocontrol) may exceed US$ 1,542 billion. However, more case studies and contributions are needed that are based, not on market values, but address utilitarian, intrinsic and option values and take into account local/private vs. local/public vs. global benefits.

Land and soils in the Convention on Biological Diversity

The Convention on Biological Diversity

The Convention on Biological Diversity, adopted by country Parties in Nairobi, 1992, is one of the three Multilateral Environmental Agreements to have emerged from the United Nations Conference on Environment and Development process. Its objectives (Article 1) are: "... the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies ..." The Convention applies to biodiversity at three levels: genes, species and ecosystems. At its sixth meeting in 2002, the Conference of the Parties adopted a target to achieve, by 2010, a significant reduction in the current rate of biodiversity loss.

The Ecosystem Approach

The Conference of the Parties decided that the Ecosystem Approach is the principle framework for the implementation of the Convention. The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. It is based on the application of appropriate scientific methodologies focused on levels of biological organisation, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognises that humans, with their cultural diversity, are an integral component of many ecosystems.

In Article 2 of the Convention on Biological Diversity, ecosystem is defined as "a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit". This definition does not specify any particular spatial unit or scale, in contrast to the Convention definition of "habitat". Thus, the term "ecosystem" does not, necessarily, correspond to the terms "biome" or "ecological zone", but can refer to any functioning unit at any scale. Indeed, the scale of analysis and action should be determined by the problem being addressed. It could, for example, be a plot of land, a pond, a forest, a watershed, a biome or the entire biosphere.

The ecosystem approach requires adaptive management to deal with the complex and dynamic nature of ecosystems and the absence of complete knowledge or understanding of their functioning. Ecosystem processes are often non-linear, and the outcome of such processes often shows time-lags. The result is discontinuities, leading to surprise and uncertainty. Management must be adaptive in order to be able to respond to such uncertainties and contain elements of "learning-by-doing" or research feedback. Measures may need to be taken even when some cause-and-effect relationships are not yet fully established scientifically.

Far left:
The Apollo butterfly is found near mountain streams, meadows where streams originate, and inundated ground. Grindelwald, Switzerland.
Photo by UNESCO MaB Programme

Left:
Alpine meadows above the timber line. The flowers and grasses that grow here have adapted to the meager conditions: nutrient-poor and frequently stony soil, and cool temperatures. Grindelwald, Switzerland.
Photo by Rudolf Schneiter

The Programme of Work on Agricultural Biodiversity and the International Initiative for the Conservation and Sustainable Use of Soil Biodiversity

Soil biodiversity has been identified as an area requiring particular attention under the programme of work on agricultural biodiversity of the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD). This programme was initiated at COP-3 (decision III/11, Buenos Aires, 1996) to promote the positive and mitigate the negative impacts of agricultural activities on agricultural biological diversity; the conservation and sustainable use of genetic resources of actual or potential value for food and agriculture; and the fair and equitable sharing of benefits arising out of the use of genetic resources. The work programme was subsequently developed, with the support of the Food and Agriculture Organisation of the United Nations (FAO), in collaboration with partners, and on the basis of advice and recommendations of the Subsidiary Body for Scientific, Technical and Technological Advice (SBSTTA) and was launched at COP-5 (decision V/5, Nairobi, 2000). It has four main objectives: assessment; management practices and policies; capacity building; and national plans and strategies and mainstreaming. FAO was invited to support development and implementation of the programme. Moreover, governments, funding agencies, the private sector and NGOs were invited to join efforts.

The COP/CBD at its 6th meeting in The Hague in April 2002 decided (COP decision VI/5, paragraph 13) "to establish an International Initiative for the Conservation and Sustainable Use of Soil Biodiversity as a cross-cutting initiative within the programme of work on agricultural biodiversity, and invites the Food and Agriculture Organisation of the United Nations, and other relevant organisations, to facilitate and coordinate this initiative". In follow up to this decision, FAO, together with EMBRAPA-SOYBEAN, organised an International Technical Workshop on Biological Management of Soil Ecosystems for Sustainable Agriculture in Londrina, Brazil, 24-27 June 2002. More than 45 participants from more than 18 countries, representing a heterogeneous range of scientists and practitioners from each region, joined efforts to review and discuss the concept and practices of integrated soil management, share successful experiences and identify priorities for action. The workshop proceedings are published in FAO World Soil Resources Report No. 101.

Consistent with the results of many other processes and fora, as an outcome of the workshop, it was proposed that the strategy for the implementation of the International Initiative on Conservation and Sustainable Use of Soil Biodiversity should adhere to the following principles:

- Focus on food security and improvement of farmers' livelihood;
- Build on previous experience and knowledge, through combining the skills and wisdom of farmers with modern scientific knowledge;
- Focus on integrated holistic solutions and technical adaptation to local contexts within a clear framework that builds on the principles for application of the Ecosystem Approach;
- Use participatory technology development and adaptive approaches to develop agricultural systems and land resource management practices for specific situations and farmer typologies that are technically and environmentally appropriate, economically viable, and socially and culturally acceptable; and,
- Develop partnerships and alliances that demonstrate multi-disciplinarity and foster synergies and ensure multi-stakeholder participation.
- Promote cross-sectoral approaches to address different perspectives (social, political, environmental) through association and flexibility.


- Prioritise actions on the basis of country goals and the needs of direct beneficiaries and locally validate such actions through the full participation of all actors.
- Promote innovative and flexible solutions that are adapted to local conditions.

This led to the development of two main objectives for the Soil Biodiversity Initiative.

Firstly, promoting awareness raising, knowledge and understanding of key roles, functional groups and impacts of diverse management practices in different farming systems and agro-ecological and socio-economic context.

Secondly, and even more important, promoting ownership and adaptation by farmers of integrated soil biological management practices as an integral part of their agricultural and sustainable livelihood strategies.

It was agreed that progress could be made through focusing on the following strategic areas of action:

1. Increasing recognition of the essential services provided by soil biodiversity across all production systems and its relation to land management, through:
   - Information sharing and networking;
   - Public awareness, education and capacity building.
2. Adoption of integrated approaches for the sustainable use of soil biodiversity and enhancement of agro-ecosystem functions; in particular in FAO's context focusing on three categories of outputs:
   - Assessment and monitoring
   - Adaptive management
   - Advocacy and training
3. Partnerships and cooperation through mainstreaming and cooperative programmes and actions.

It is intended that the suggested principles, development process, strategy and priority actions presented in this workshop report provide a preliminary basis to further stimulate exchange of information and experiences among countries and relevant institutions. This should lead to a coordinated process for the establishment and conduct of the Soil Biodiversity Initiative (SBI), as established under COP Decision VI/5 (The Hague, April 2002), as a cross-cutting initiative within the CBD programme of work on agricultural biodiversity, with the coordination and technical and policy support of FAO.

The findings and recommendations in regard to the three main strategic areas considered at the Londrina workshop are presented in the form of a framework for action that outlines proposed objectives and activities. It is envisaged that this framework will provide the basis for the further development and implementation of the International Initiative on the Conservation and Sustainable Use of Soil Biodiversity, further referred to as the SBI, as an integral part of the programme of work on agricultural biodiversity. It will be a partnership effort by FAO, the CBD Secretariat and Parties, and other interested partner organisations and bodies.

Framework for action as a basis for further development of the Soil Biodiversity Initiative

Objective 1. Sharing of knowledge and information, and awareness raising

- Activity 1.1. Compilation and dissemination of case studies for use in awareness raising and capacity building.
- Activity 1.2. Creation and strengthening of networking arrangements for sharing of information, experiences and expertise with a focus on supporting local initiatives on the ground rather than institution building.
- Activity 1.3. Enhancing public awareness, education and knowledge on integrated soil management and agro-ecological approaches.

Far left:
Alpine meadows, high in soil biodiversity, formerly flood irrigated, nowadays irrigated by sprinkler, Wallis, Switzerland.
Photo by Hanspeter Liniger

Left:
Typical land use pattern in rural Laos: A settlement with gardens, fishponds and irrigated rice fields (paddy) near Phonesavanh, northern Laos.
Photo by Thomas Kohler

– Activity 1.4. Development of information systems and databases.

Objective 2. Capacity building for the development and transfer of knowledge of soil biodiversity and ecosystem management into farmers' practices

– Activity 2.1. Evaluating capacity building needs of farmers and other land managers, researchers and development programmes for integrated soil biological and ecosystems management.
– Activity 2.2. Development of soil bioindicators and tools for assessment and monitoring of soil health and ecosystem functioning.
– Activity 2.3. Promotion of adaptive management approaches for the development and uptake of improved soil biological management practices, technologies and policies that enhance soil health and ecosystem function and contribute to sustained agricultural productivity and livelihoods.
– Activity 2.4. Mobilisation of targeted participatory R&D in order to enhance understanding of soil biodiversity functions and ecosystem resilience in relation to land use and sustainable agriculture.

Objective 3. Strengthening collaboration among actors and institutions and mainstreaming soil biodiversity and biological management into agricultural and land management and rehabilitation programmes

– Activity 3.1. Mainstreaming soil biodiversity and ecosystem management in agricultural and land management programmes and policies.
– Activity 3.2. Develop partnerships and collaborative activities for development and implementation of the Soil Biodiversity Initiative as an FAO-CBD partnership.

The Programme of Work on Biodiversity of Dry and Sub-humid Lands, and the Joint Programme of Work of the CBD and the UNCCD

At its fifth meeting in May 2000, the Conference of the Parties adopted the programme of work on dryland, Mediterranean, arid, semi-arid, grassland, and savannah ecosystems, also referred to as programme of work on "dry and sub-humid lands", as contained in decision V/23. In this regard, an ad hoc technical expert group (AHTEG) on dry and sub-humid lands was established to carry out, among others, the following tasks:

– Consolidate and assess information on status, trends, indicators, benefits of dry and sub-humid land biodiversity and impacts of its loss;
– Assess the progress and the effects of the specific measures taken for the conservation and sustainable use of biodiversity; and
– Assess international priorities set up at the regional and global levels and make proposals for further activities.

The Convention's work programme seeks to fill gaps in our knowledge base by assessing the status of, and threats to, the biodiversity in dry and sub-humid lands. It supports best management practices through targeted actions in response to identified needs. It also promotes partnerships among countries and institutions. The work programme further aims to promote synergies and coordination between related conventions, in particular the United Nations Convention to Combat Desertification.

Cooperation with the UN Framework Convention on Climate Change

There are significant opportunities for mitigating climate change, and for adapting to climate change, while enhancing the conservation of biodiversity. Mitigation involves reducing the greenhouse gas emissions from energy and biological sources or enhancing the sinks of greenhouse gases.

Adaptation is comprised of activities that reduce a system's (human and natural) vulnerability to climate change. In order to realise these opportunities there is close cooperation between the CBD and the UN Framework Convention on Climate Change. Land-use, land-use change and forestry activities can play an important role in reducing net greenhouse gas emissions to the atmosphere. Biological mitigation of greenhouse gases through land use, land-use change and forestry (LULUCF) activities can occur by three strategies the conservation of existing carbon pools, and the sequestration by increasing the size of carbon pools. There are a large number of agricultural management activities (e.g., conservation tillage, erosion control practices, and irrigation) that will sequester carbon in soils, and which may have positive or negative effects on biodiversity, depending on the practice and the context in which they are applied. Conservation tillage denotes a wide range of tillage practices, including chisel-plow, ridge-till, strip-till, mulch-till, and no-till that can allow for the accumulation of soil organic carbon and provide beneficial conditions for soil fauna. The use of erosion control practices, which include water conservation structures, vegetative strips used as filters for riparian zone management, and agroforestry shelterbelts for wind erosion control can reduce the displacement of soil organic carbon and provide opportunities to increase biodiversity. The use of irrigation can increase crop production, but has the potential to degrade water resources and aquatic ecosystems.

A new mechanism in support of soil and land management

The 17th World Congress of Soil Science, Bangkok/Thailand, August 14-21, 2002, concerned by the fact that soil and land degradation remains a largely unresolved problem of global environmental change decided to actively promote the "World Soils Agenda" of its Working Group "International Actions for the Sustainable Use of Soils" (IASUS), including identifying an international, multi-disciplinary network for soil issues and establishing an international (inter-governmental) panel on soils.
The key existing UN organisations for land and soils are the Rio Conventions, UNCCD, CBD and UNFCCC and FAO. There are opportunities within the existing instruments for developing and promoting appropriate policies, programmes and practices, for example through the CBD/FAO Soil Biodiversity Initiative and through closer cooperation among the three Rio Conventions on soils-related issues in order to promote synergies among the objectives of conserving soil biodiversity, reducing land degradation and promoting carbon sequestration and the reduced emission of greenhouse gases.

Conclusion

Policy makers, technicians and land users need to be convinced of the need for, and potential benefits of, managing soil biological processes and addressing soil management in a comprehensive way, in order to address issues of increasing land degradation, nutrient depletion, fertility decline, water scarcity, crop productivity and yield reductions. All these factors affect negatively the livelihoods of people who directly depend on agriculture for their subsistence and, in some cases, the resulting degradation and consequences on rural population are alarming. They are also affecting the viability and sustainability of commercial agriculture.
Furthermore, unless in particular the role of biodiversity in enhancing resilience is understood and factored into effective policy or institutional interventions, ecosystem diversity is unlikely to be maintained at the landscape scale without deliberate policy interventions at national and

sub-national levels which take into account the real value of maintaining ecosystem services, given the externalities they generate and given their contribution to resilience.

It is worth recalling that loss in beneficial functional groups of soil organisms may lead to loss in key ecosystem processes (decomposition, nutrient cycling, and soil structure), with important consequences in terms of land degradation, crop productivity decline and food insecurity and poverty. There is a need to build the skills and information and capacity of farmers and other land users for adaptive management approaches. There is also a need for the development of coordinated policies, strategies and incentives that encourage land use and management practices that, simultaneously, reduce soil erosion, sequester soil carbon, restore nutrients, retain water and conserve soil moisture. Sustainable agriculture should make better use of goods and services provided by the range of natural ecological processes, such as nutrient cycling, nitrogen fixation, soil regeneration and pest control. It should also minimise the use of non-renewable inputs (pesticides and fertilizers) that are costly, damage the environment or harm the health of farmers and consumers.

Finally, ensuring due attention to the conservation and sustainable use of soil health and soil biological functions in the policy and development agenda requires greater recognition of the important role that soil organisms play in ecosystem functioning and processes and the economic benefits of the environmental services they provide. Nonetheless, the main constraint is the actual lack of information, analysis, and case studies dealing with both the soil ecological functions and the economic benefits.

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Background

Based on the discussions held at the IASUS Symposium in Freiburg, Germany, on 9 September 2004, a survey was developed for consultation with members of the IASUS Working Group in 2005, and a workshop held at ISRIC on 9 - 10 March 2006.

Part III covers the results of this survey and its concretisation in setting a number of priorities, as well as concrete actions at the international and regional levels.

Contents

Half moons on a compact surface area, Niger. Mulching increases infiltration and soil biology, and reduces evaporation.
Photo by Hanspeter Liniger

part III

Priority setting for further action

A survey in 2005 on IASUS recommendations

Presentations and discussions at the Freiburg Symposium of 9 September 2004 resulted in a number of options for follow-up activities by the IASUS network. In 2005, the contributors to the meeting were asked to rate the relevance of the proposed options and add their comments.

The survey aimed to assess the capacity of these options as strategies for improving policies relevant to soils and sustainable land management.

Respondents were asked to rate the options and to give reasons for their choices. The scores, from 0 for "no relevance" to 3 for "high relevance" were added up, and a ranking was established based on the total score for each option (cf. Fig. 9).

The ratings reveal a fairly distinct difference between the most and the least preferred options, with all others clustered together in between. "Strengthen issues of soils and sustainable land management in existing multilateral environmental agreements" received the highest score and was hence seen as the most-preferred option for future action by the network. The least relevance was assigned to "promoting sustainable land management at the EU level". Of the remaining options, "making IASUS a "World Soils Council" and thus a major voice in the international arena" scored highest in line with "addressing the impacts of current policies on sustainable land management". In terms of the variability of the scores, the top three options also happen to be the ones with the highest agreement amongst the respondents.

Respondents also made comments to explain their choices among the nine options:

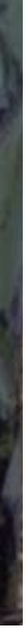
1. Strengthen issues of soils and sustainable land management in existing multilateral environmental agreements was favoured not least for pragmatic reasons, on the assumption that there would be less resistance to such action if it focused on existing agreements instead of new policy instruments. It was further recommended to join forces with similar initiatives in other institutions, and to interact with the respective technical and political bodies of the multilateral environmental agreements, such as the Committee on Science and Technology of the UN Convention to Combat Desertification (UNCCD).

2. Make IASUS a "World Soils Council" and thus a major voice in the international arena was well received, but scepticism was expressed with regard to the political backing of governments and international organisations needed for a new and influential body.

3. The need to address impacts of current policies on sustainable land management was widely supported and the network was seen as being in a good position to undertake such assessments comprehensively, based on a mandate and sufficient funding.

4. Some doubt was expressed about the value of addressing and emphasising benefits of sustainable land management and soil functions. Supportive action by the network was well received, based on the full valuation of sustainable land management. Examples of recommended action included the development of tools and guidelines for illustration and diffusion of benefits from sustainable land management to specific stakeholders and the general public.

5. Strengthen existing programmes assessing soil degradation and land management received mixed reactions by the respondents. Despite criticism of the impacts of existing assessment programs, it was



Left:
Traditional banana mulching in Uganda.
Photo by Will Critchley

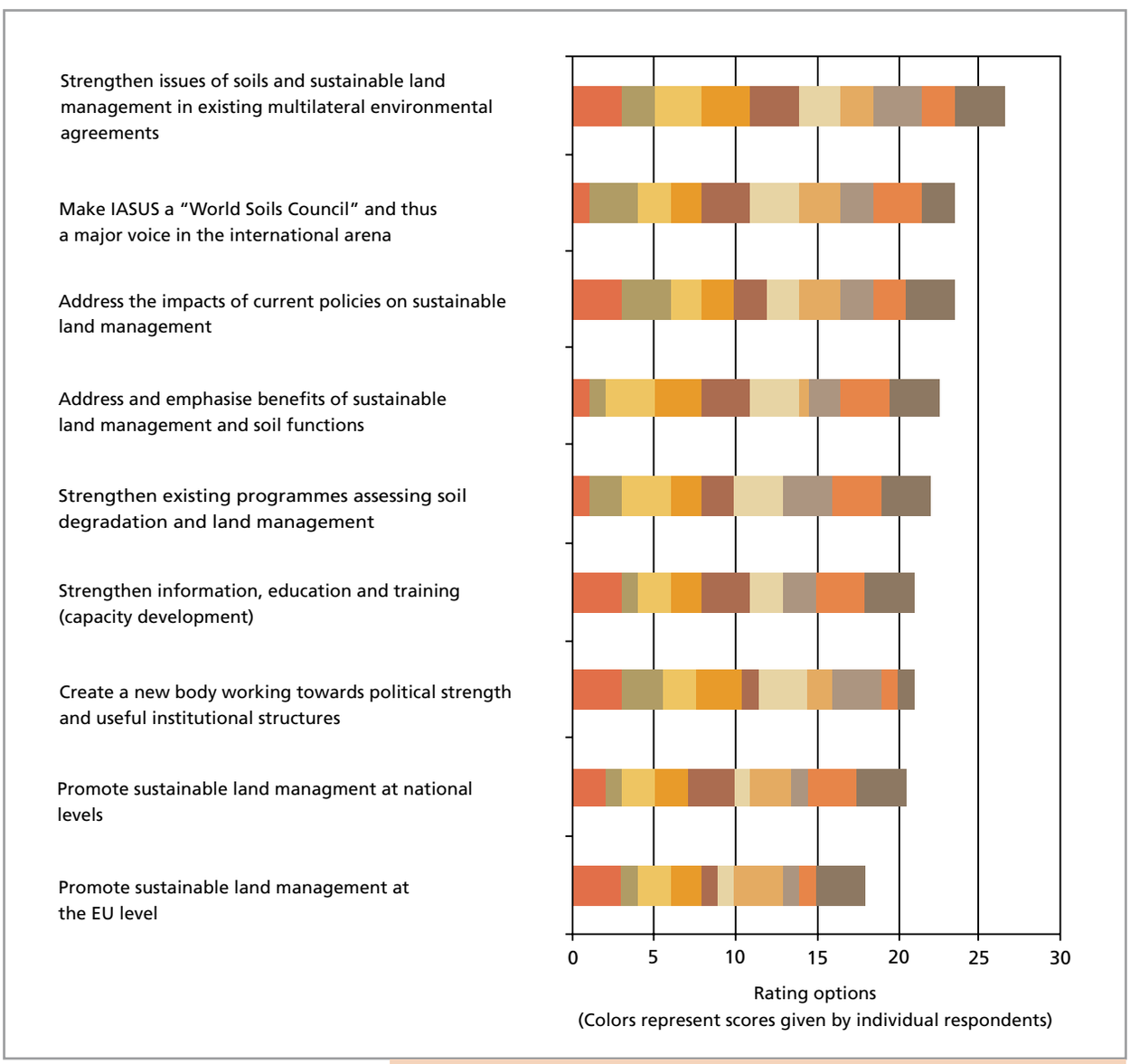


Figure 9: Rated options for further action

acknowledged that significant improvements had been achieved, such as assistance for the Land Degradation Assessment (LADA) from the Global Environment Facility of the World Bank. Further progress was said to be underway, through interventions by other bodies.

6. Strengthen information, education and training (capacity development) was not seen as a stand-alone activity but an essential component of any effective action by the network.

7. Create a new body working towards political strength and useful institutional structures received mixed reactions. While some respondents argued for the need and the potential benefits of a new body, others rejected it because of expected widespread and influential hesitation to launch such an initiative.

8. Promote sustainable land management at national levels received mixed reactions. The need for a network with a global perspective to focus on national-level activities was questioned. However, it was mentioned that positive actions by land users in the field depend, above all, on decisions and guidance by national level entities. Furthermore, any successful intervention at international and intergovernmental levels would require initiative and support by national governments.

9. Promote sustainable land management at the EU level. The EU Thematic Strategy on Soils was said to be progressing well, with little need for the network to intervene. The EU was seen as a potential key ally for the network, providing necessary and strong support for possible joint actions in the future. Hence, cooperation with relevant EU bodies was seen as an advisable strategy for strengthening the network, its outreach, and its impact.

Far left:
Irrigated agriculture near Jalalabad, Kyrgyzstan.
Photo by Hans Hurni

Left:
Charcoal sold along the highway from Antananarivo to Fianarantsoa, Madagascar. Charcoal provides livelihoods but also contributes to the destruction of natural forests.
Photo by Markus Giger

Relevance to further action: conclusions of the IASUS survey

A number of conclusions relevant to the undertakings of the network can be drawn from the outcome of this survey.

Conclusions regarding the role, mission and approach of the network

IASUS is a voluntary international, science-based and policy-oriented network of specialists on soils and land established by the International Union of Soil Sciences (IUSS). Despite limited resources, the network is well positioned to contribute to improved policy conditions for addressing the global concerns of soil degradation and enhancing sustainable land management (SLM) by combining the strengths of its individual members, stemming from many different disciplines such as soil science, agronomy, economy, law, geography, and social sciences.

The objective of the network is to promote sustainable land management and remove the conditions that cause human-induced land degradation and associated negative impacts on the environment and well-being.

The network strategy aims to increase awareness among stakeholders (and the general public), improve dialogue on effective policies and measures, and strengthen the positioning and outreach of the network.

The network seeks to advise governments, intergovernmental institutions and other key stakeholders based on assessments of global soil and land issues, the effects of policies and practices, and the benefits of sustainable land management.

The network seeks to fund its activities through third party finance and in-kind contributions from its members.

Conclusions regarding future activities of the network

The network aims to create an advisory body for governments and other stakeholders on soil and land issues. This body – to be named the "World Soils Council" - would seek to serve as a major scientific and advisory voice on soil protection and sustainable land management issues in international policy debates and processes.

The IASUS network proposes to serve as the nucleus of such a body and draw in other interested organisations, parties and individuals, so as to:

- Assemble a body of expertise and experience that acts as an advocacy group for soil and land issues in policy and decision-making processes;
- Clarify the procedural requirements for the creation of a high-level scientific and advisory council on land and soil attached to existing international conventions and treaties;
- Identify and evaluate impacts of current policies on sustainable land management and the capacities of existing policy frameworks and institutional arrangements to strengthen issues of soils and sustainable land management;
- Support efforts to document and highlight the benefits of sustainable land management and soil functions and ways to promote them at different levels;
- Evaluate the impacts of programmes that assess soil degradation and land management and propose ways to make them more effective.

Priority setting for future activities

Following the results of the survey, IASUS proposes three initiatives.

1st Priority

"Creating a World Soils Council"

Based upon the two options:

- *Make IASUS a "World Soils Council" and thus a major voice in the international arena*
- *Create a new body working towards political strength and useful institutional structures*

Background

Reforming the United Nations also affects UN institutions in the environmental field. In 2001 the German Advisory Council on Global Change (WBGU) contributed to the discussion with its annual report "World in Transition – New Structures for Global Environmental Policy" proposing a new Earth Alliance as a vision for the restructuring of international environmental institutions and organisations. On its own initiative, and following the example of the IPCC, the Advisory Council proposed the establishment of comparable scientific bodies to advise and support international soil policy.

The idea of an Intergovernmental Panel on Land and Soils (IPLS) has since been advocated and discussed at various venues, for instance at COP-5 of UNCCD (2001) and the IASUS Symposium of the EUROSOIL congress in Freiburg (2004). In its 2004 report on "Fighting Poverty through Environmental Policy", the German Advisory Council reiterated this proposal. However, political support for the notion of institutional reform seems to be minimal at this time. But the need for a stronger voice representing the concerns of soil and land use issues in the international environmental policy arena remains undisputed.

Goals

1. Transforming the IASUS network into a "World Soils Council", an important voice for soil and land use issues in the international environmental policy arena.

2. Strengthening soil and land use perspectives in undertakings to promote more effective international environmental policy mechanisms.

Activities

1. Founding the "World Soils Council" at the ISRIC Symposium of March 9-10, 2006.
2. Seeking explicit support from the IUSS General Assembly to formally associate IUSS with the "World Soils Council".

Expected result

An effective voice for soil and land issues in the international policy arena.

Background

There is growing political pressure for cooperation among existing multilateral environmental agreements (MEA) to promote the Millennium Development Goals and the objectives of the agreements. Fostering synergies among the three Rio Conventions – UNFCCC, CBD und UNCCD – should make the agreements more effective at all levels. A synergetic approach can also emphasise the central role of soils within climate change, biodiversity and desertification, and hence strengthen soil protection and encourage sustainable land management.

Cooperation and synergies are on the agenda of several forums, including a Joint Liaison Group of the three Rio Conventions established in 2001. Most recently, this was discussed at COP-7 of UNCCD (October 2005), and the World Meteorological Organization (WMO) has organised a workshop in 2006 on the inter-linkages between climate and land degradation.

2nd Priority

"Fostering Synergies among MEAs for Soil Protection and Sustainable Land Management"

Based upon the two options:

– *Strengthen issues of soils and sustainable land management in existing multilateral environmental agreements*

– *Address impacts of current policies on sustainable land management*

Goals

1. Strengthen issues of soil protection and sustainable land use in the context of the Rio Conventions.

2. Make use of the "World Soils Council" in the debate for effective multilateral environmental agreements as a competent voice on behalf of soil and land use issues.

Activities

1. Develop a background paper highlighting the importance of soils and land use in the context of the Rio Conventions, and assess ways and means to emphasise soil and land issues in the on-going debate on synergies.

2. Selective participation in on-going processes concerned with synergies between the Rio Conventions and the soil and land-use links of the different conventions individually.

Expected result

Soil protection and sustainable land use is a firmly established theme in the synergies process of the Rio Conventions and in the conventions themselves.

Background

The low profile of soil and land use issues in international environmental policy can be explained by (a) underestimation of soil and land degradation, and (b) limited understanding of soil functions and services for the natural environment and in resource use. Soils and sustainable land management are undervalued in the agenda-setting process for policy responses to environmental concerns.

Programmes assessing land degradation and providing assistance for soil and water management designed to limit degradation do exist but their impact is criticised as being minimal and having achieved less than the potential benefits.

3rd Priority

"Promoting Sustainable Land Management"

Based upon the three options:

- *Address and emphasise benefits of sustainable land management and soil functions*
- *Strengthen existing programmes assessing soil degradation and land management*
- *Promote sustainable land management at national levels*

Goals

1. Strengthen the status of soil and land use issues in international environmental policies as well as in broader policy and development frameworks through comprehensive valuation of soil functions and sustainable land use.

2. Improve understanding by major players of the benefits related to soil functions and sustainable land use.

3. Enhance the relevance of soil and water conservation programmes like WOCAT for policymakers, land users and other relevant stakeholders.

Activities

1. Build links to other initiatives and programmes on the valuation of soil functions and sustainable land management.

2. Campaign for soils by undertaking mutually supporting events to present and discuss the implications of a full valuation of soil and sustainable land use benefits.

3. Approach key stakeholders to discuss implications and responses needed to foster sustainable land management at different levels.

Expected result

Stakeholder-focused campaign on benefits of soil protection and sustainable land management achieved.

Higher market integration is essential for investments in the land. Rural markets such as the one in Anjeni, Ethiopia, need to be better linked to economic centres. Photo by Eva Ludi

Summary of ISRIC Symposium of 9-10 March 2006

Anniversary seminar

The symposium was organised in Wageningen, The Netherlands on the 40th anniversary of ISRIC - World Soil Information. It consisted of two parts: a seminar and a workshop. On 9 March the anniversary seminar "World soil issues and sustainable development: an agenda for action" covered issues such as "Achieving the Millennium Development Goals (MDGs) in Africa" (Pedro Sanchez), "Global Soil Issues" (David Dent), "Soil Organic Carbon" (Carlos Cerri), "Global Land Change and Soil Dynamics" (Tom Veldcamp), "Integrated Management of Soil and Water in Africa" (Nuhu Hatibu), and "Soils in the International Arena" (Hans Hurni). These presentations were followed by a plenary discussion chaired by Don Sparks (IUSS president) on the main topic, a "Soils Agenda for Action", and a ceremony at ISRIC's World Soil Museum, where Luca Montanarella (EC), Pedro Sanchez (Colombia University) and Johan Bouma (Wageningen University) were inaugurated as Honorary Fellows of ISRIC.

Special workshop

On 10 March a special workshop was organised to continue the discussion about soils and policy making. The workshop started with four invited inputs, followed by a broad discussion from which emerged a consensus to use the event to initiate the "World Soils Council".

Pedro Sanchez (The Earth Institute) introduced the topic by asking how to get soils into international dialogue. He stressed that there should be a supply side (what do people need to know?), and a demand side (what do policy makers want to know about soils?). He emphasised the need to provide scientifically solid and georeferenced data, not just on soils, but also on land and soil degradation, soil-water issues, and soil functions and services for human health and the environment.

Stephen Nortcliff (IUSS Secretary General) introduced the European Soil Protection Strategy, emphasising soil functions for food and biomass production, storing and filtering water, nutrients and waste, providing habitat, and serving as a gene pool; listing threats such as soil erosion, loss of organic matter, contamination, sealing and compaction, soil biodiversity decline, salinisation, and landslides. Cycles in policy making need to be well recognised; they start with policy formulation, which should be knowledge-based, participatory, and allow a choice of instruments. Basic instruments in policy making should be based on the "polluter pays principle", but focus on prevention and precaution, rectification at the source, and subsidiarity. A successful soils policy in Europe should be linked to the current Common Agriculture Policy. There exist directives relating to Soil Monitoring (2004), and a Soil Framework (2006), as well as a legal framework on soil protection and sustainable use.

Johan Bouma (Wageningen) stressed that personal engagement is the key link between soil science and policy making, and that the regional scale is appropriate for solving land use problems. There is a need to transform scientists from disciplinary-oriented science ("mode 1") to integrative science ("mode 2"). This would result in the following steps for involvement of science in policy making: participating in negotiation processes by offering options instead of solutions; following the policy chain of signalling, designing, deciding, implementing and evaluating; organising interdisciplinary projects in which soil scientists can act as leaders; focusing on relations

between policy makers and stakeholders; getting into interaction by offering first simple results ("K1" level of knowledge) and moving step-by-step to cutting edge results ("K5" knowledge) only if needed; providing geographically explicit results on maps rather than in summaries and tables; joining the information revolution by applying interactive modelling, 3D visualisations, web-based models and data bases; and finally, forming interdisciplinary communities of scientific practice - not necessarily all participatory, but with diversified rewarding packages.

Charles Rice (IUSS) emphasised the role of soil science in global science and the politics of global change, and reported on his experience in the process of the Intergovernmental Panel on Climate Change (IPCC), particularly relating to "mitigation agriculture". The need to think "glocally", i.e. both globally and locally, is important when motivating land managers to apply management practices that result in reduced carbon emission levels, or to enhance carbon sequestration in soils. Economic issues are important, e.g. the question whether it is cheaper to reduce carbon emissions at the source (outside agriculture) or by enhancing carbon sequestration. For the US, the value of Soil Organic Matter (SOM) was estimated at 0.20 US$ per kilogram; hence 1% SOM would amount to 2700 US$ per hectare of land.

A discussion of general issues of soils and policy followed. Stein Bie (ISRIC Board Chairman) suggested bringing a "green box" into negotiations at the World Trade Organisation (WTO). David Dent (ISRIC Director) proposed "Green Water Credits" as a mechanism to pay land users for water management activities that are presently unrecognised and unrewarded. Carlos Cerri pointed out that, so far, soils are not eligible for the Clean Development Mechanism (CDM) of the Kyoto Protocol, unlike reforestation, although soils have a far greater potential for long-term sequestration than living biomass. Luca Montanarella (EU JRC) explained that in the EU's Common Agriculture Policy there is a shift from subsidy (of products) to "green box" mechanisms, i.e. payments for environmental services. This will reduce the current global distortion due to subsidised production, and the payments can be used to combat land degradation, enhance soil organic matter, and preserve soil biodiversity. Godert van Lynden (ISRIC) pointed out that conservation agriculture in Europe was able to reduce soil erosion by about 25%. Sjef Kaufmann (ISRIC) underlined this need to pay for environmental services in all northern states. Nuhu Hatibu (ASARECA) emphasised that subsidy systems need to be transformed into strategic public investments - particularly in Africa, where rock phosphate investments are urgently needed to enhance soil fertility; Pedro Sanchez referred to experience in the Brasil Cerrado region, where rock phosphate has been subsidised for the past 20 years. David Dent referred to Australia, where no subsidy system is used, but with the result that soils have been mined. Don Sparks warned that soils should not be exclusively associated with agriculture, since many other land and soil uses are equally important. Relating to current soil science Leo Stroosnider regretted that there is a "measurement crisis", as less and less field measurements are funded, although they are indispensable to validate models. Don Sparks added that many nanoscale measurements are made at present, but these need to be up-scaled.

In conclusion, David Dent urged that the soil science community should have a common, authoritative voice. He cited the Intergovernmental Panel on Climate Change (IPCC) as a success to alert the public and politicians about climate change. The idea of an Intergovernmental Panel on Land and Soils (IPLS) would be another such

Far left:
Greening Kenya: Children at work in their school tree nursery. Laikipia District, Kenya.
Photo by Thomas Kohler

Left:
Despite a booming tourist sector, farming, including livestock rearing, has remained important for local livelihoods. Namche Bazar, Khumbu/Everest Region, Nepal.
Photo by Sanjay Nepal

opportunity, but has not (yet) found broad enough acceptance. Hans Hurni emphasised that so far, the International Union of Soil Sciences (IUSS) has been the institution that has taken the initiative to speak with "one common voice", by installing the IASUS Working Group in 1998 and adopting the "World Soils Agenda" in 2002. These initiatives could be carried forward at the next World Congress of Soil Sciences (WCSS) in July 2006 by proposing the establishment of a "World Soils Council" (WSC), building on the Working Group. This could act as a common voice in different forums, provided that it is composed of an interdisciplinary group and not soil scientists alone, and focused on soil-related themes critical for global sustainability. Membership in the WSC could be broad, rather informal, and based on initiatives by various subgroups. It would be important, however, for the WSC to have a fixed home-base, where scrutiny of messages will be reviewed and guaranteed. ISRIC was seen as the most suitable institution for assuming such responsibility, at least as long as there is no international institution or convention to raise the council to the inter-governmental level. A first step would thus be to establish a secretariat, launch a stakeholder consultation process, and develop a work plan for the coming years. The 18th WCSS would be the best time for formal adoption of such a process.

Palisade construction against wind erosion in Niger.
Photo by Hanspeter Liniger

Creating a World Soils Council (WSC)

The main result of the ISRIC Workshop on "World Soil Issues and Sustainable Development" was that participants unanimously agreed to initiate a "World Soils Council", to be hosted by ISRIC, and with an institutional set-up to be developed based on the outcomes of the 18th WCSS to be held in Philadelphia in July 2006.

The WSC's vision

Sustainable soil management for healthy soil, healthy people and a healthy environment.

Objectives of the WSC

- Assemble an interdisciplinary body of expertise and experience that acts as an advocacy group for soil issues in policy and decision-making processes;
- Identify and evaluate the impacts of current policies on sustainable soil management, and the capacities of existing policy frameworks and institutional arrangements to strengthen issues of soils and sustainable land management;
- Support efforts to document and highlight the benefits of sustainable soil management and soil functions and ways to promote them at different levels;
- Evaluate the impacts of programmes assessing soil degradation and land management, and propose ways to make them more effective;
- Clarify the procedural requirements for the creation of a high-level scientific and advisory council on (land and) soil attached to existing international conventions and treaties.

Structure of the WSC

The WSC would consist of a council of members who work in the Council on a voluntary basis. The background for membership will be broad, from soil sciences to agriculture, geography, environmental sciences, and from social and economic fields to law and political science. The common denominator for membership is the vested interest and experience, in science, practice and politics, of WSC members in soil-related global and local issues.

The WSC would have a secretariat hosted at ISRIC, which coordinates the activities of the council, prepares the work of the council, develops projects to be submitted for funding, and issues policy and science-related statements on behalf of the council.

An advisory forum of stakeholders could be established in support of the council, e.g. for developing ideas, reviewing outputs and policy statements, backstopping on reactions, or providing wider brainstorming opportunities.

Funding

All initiatives of the "World Soils Council" will depend on the ability to raise funds, in-kind contributions from the involved members, and partnerships with supportive organisations. Funding will need to be secured in order to elaborate substantial inputs to the on-going processes in which the network will participate.

Annex

Contributors invited to the Eurosoil Symposium

Winfried E.H. Blum, Institute of Soil Research, University of Natural Resources and Applied Life Sciences, Vienna, Austria

David Dent, ISRIC – World Soil Information, Wageningen, the Netherlands

Markus Giger, Centre for Development and Enviroment, University of Bern, Switzerland

Hartmut Grassl, Max-Planck-Institut für Meteorologie, Hamburg, Meteorologisches Institut, Universität Hamburg, Germany

Hans Hurni (Chairman IASUS), Centre for Development and Environment, University of Bern, Switzerland

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Michael Stocking, Professor of Natural Resource Development, University of East Anglia, Norwich, UK & Lead Consultant for UN/FAO, LADA preparation

Anna Tengberg, Division of GEF Coordination, UNEP, Nairobi

Joachim Woiwode (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU), Germany

Godert van Lynden, ISRIC – World Soil Information, Wageningen, the Netherlands

Programme of the IASUS Symposium at Eurosoil on 9 September 2004

Introduction		
8:30-8:50	Hans Hurni	The IUSS World Soils Agenda
Session 1:	**Science to support policies for sustainable land management**	
8:50-9:20	Michael Stocking	LADA – Land Degradation Assessment in Drylands
9:25-9:55	Godert van Lynden	Furthering Sustainable Land Management through the global WOCAT network
10:00-10:30	David Dent	Global Assessment of Land Degradation and Improvement and Early Warning
10:30-11:00	*Coffee break*	
Session 2:	**Strategies to support sustainable land management**	
11:00-11:30	Jens Mackensen	The UNEP Ecosystem Approach to Land Use Management and Soil Conservation
11:30-12:00	Luca Montanarella	The European Commission Thematic Strategy for Soil Protection
12:00-12:30	Joachim Woiwode	Furthering Sustainable Land Management: The German Approach
12:30-13:00	Hartmut Grassl	The Initiative for an International Panel on Land and Soils (IPLS)
13:00-14:30	*Lunch break*	
Session 3:	**International experiences to support sustainable land management**	
14:30-15:00	Markus Giger	Soil and Land in the Millennium Ecosystem Assessment and UN Conventions
15:05-15:35	Anna Tengberg	Funding Sustainable Land Management through the Global Environment Facility
15:40-16:10	Winfried E.H.Blum	Challenges for global Mechanisms to Sustainable Land Management: a synthesis of Symposium contributions
16:10-16:40	*Coffee break*	
Session 4:	**Challenges for global mechanisms to support sustainable land management**	
16:40-18:20	Hans Hurni (chair)	Panel Discussion

A number of international mechanisms have recently included soils as a natural resource of vital importance. Be it for carbon sequestration, soil biodiversity preservation, ecosystem services, as a basis for agricultural production, or simply a living space, soils have multiple functions that are vital to global sustainability. The present publication assembles information and experiences from a number of key stakeholders with a land management background. These specialists met in an international symposium, discussed their experiences, and developed priorities for further action in support of the World Soils Agenda, which was developed by the IUSS Working Group IASUS and adopted by the International Union of Soil Sciences (IUSS). Concrete actions are here proposed for improving international mechanisms in support of sustainable land management.

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Working Group IASUS:
International Actions for the
Sustainable Use of Soils

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